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softalk

for the IBM Personal Computer

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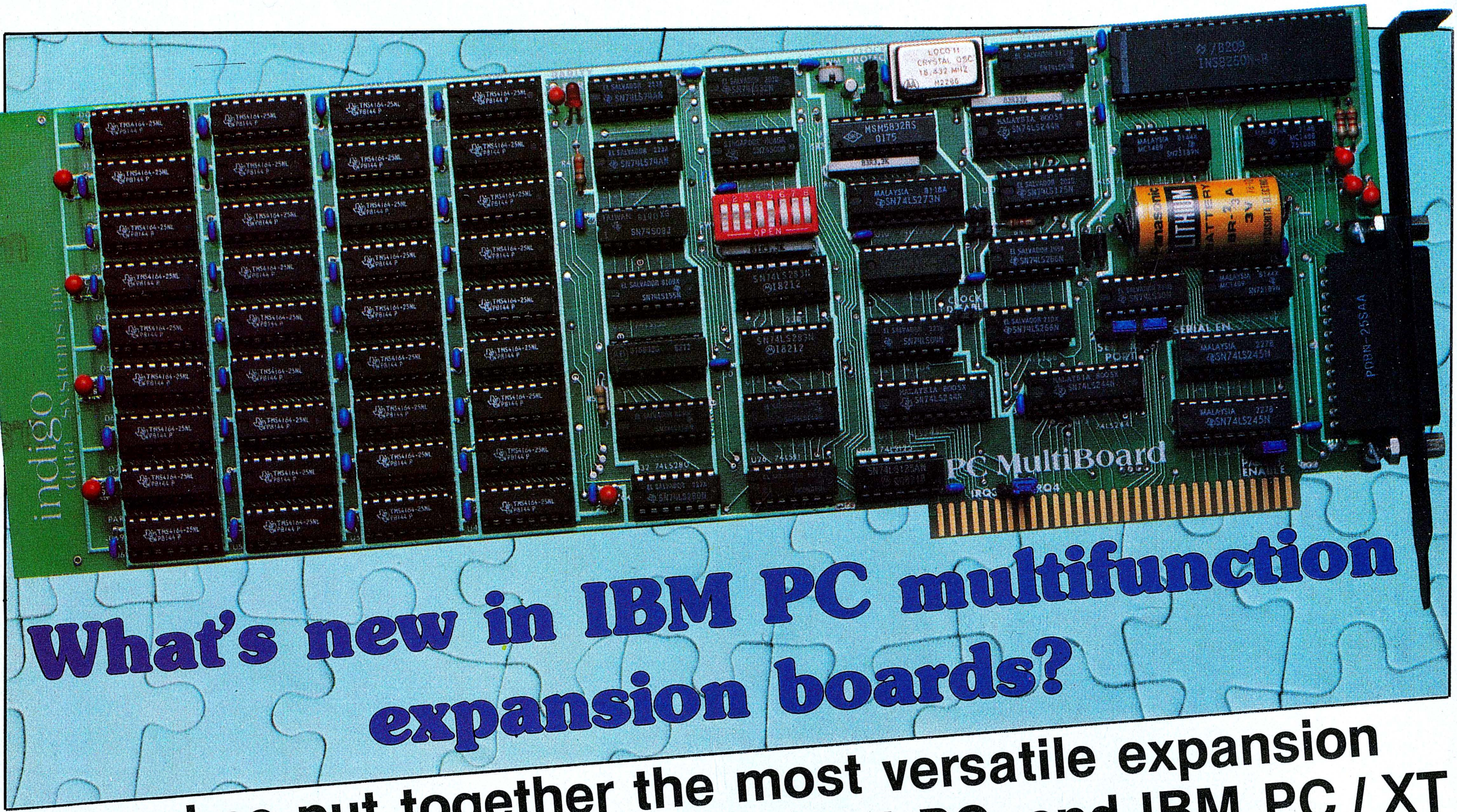
THE PC IN THE U.K.



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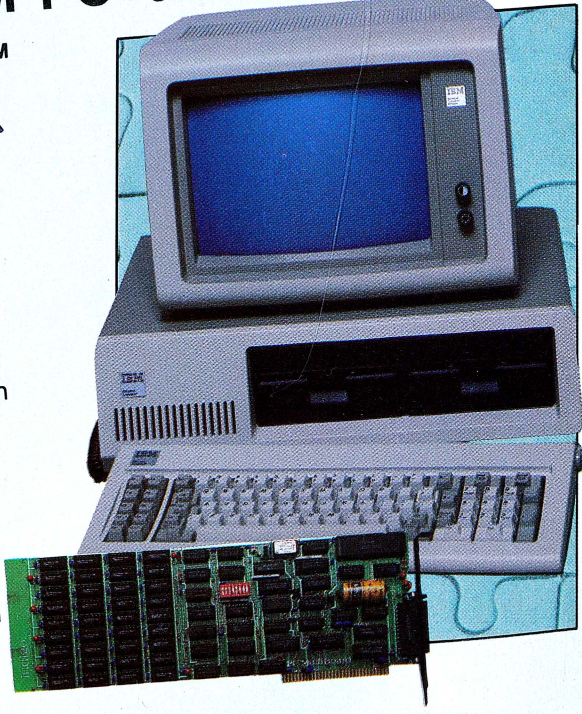

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for the IBM Personal Computer

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Cover photography by Toris von Wolfe; location courtesy of The Avenue Saloon, Los Angeles, CA.

Composition by Photographics, Hollywood, California. Printing by Volkmuth Printers, Saint Cloud, Minnesota.

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Postmaster: Send address changes to Softalk/IBM, Box 60, North Hollywood, CA 91603.

Subscriptions: Complimentary trial subscription to all owners of IBM Personal Computers and Compaq computers in the USA. If you own a pc or a Compaq but you aren't receiving *Softalk for the IBM Personal Computer*, send your serial number and mailing address to Softalk/IBM Circulation, Box 60, North Hollywood, CA 91603. Non-pc-owners subscriptions: $24 per year. Please allow six to eight weeks for processing. Back issues (from June 1982): $3. *Softalk for the IBM Personal Computer* is totally independent of International Business Machines.

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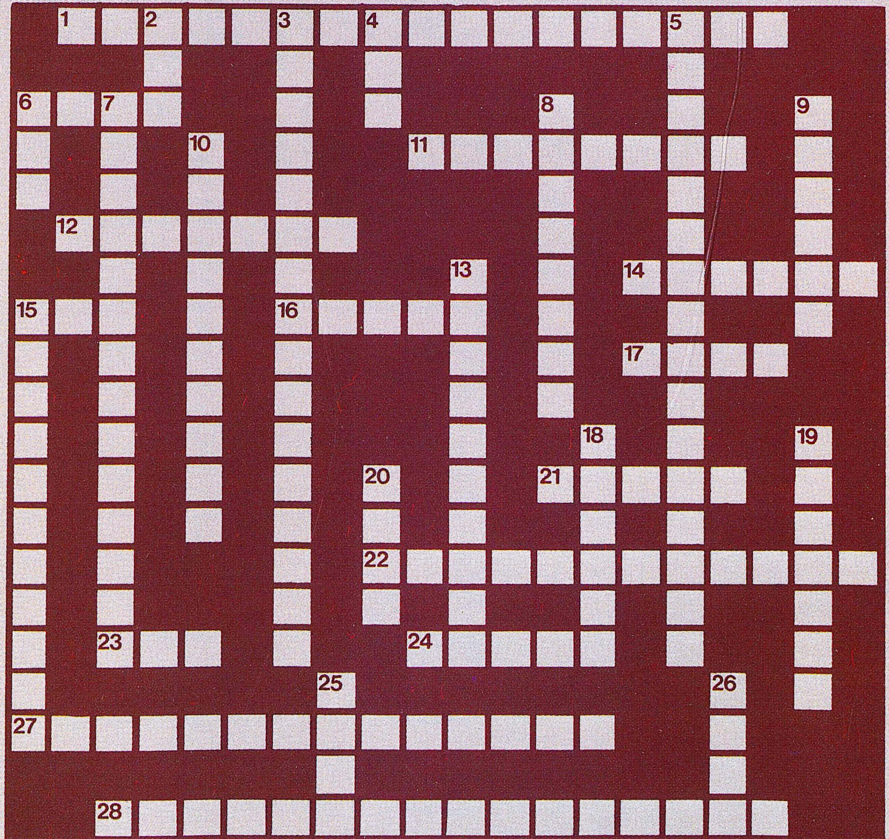
ALL THE WORDS THAT FIT

After several issues of specialized contests, here's one anyone can win. Most of the words needed are right under your nose, somewhere in this issue. Names of advertisers, columnists, editorial people, and so on are mixed with a few common computer terms.

All you need to do to win $100 worth of software is send a list of the twenty-eight correct answers to: World's Most Challenging Crossword, Softalk for the IBM Personal Computer, Box 60, North Hollywood, CA 91603. The random number generator will choose the winner. Your list must be complete and correct to qualify.

Also, tell us what you want if you win and give us your phone number in case you're one of the fortunate few. Prizes must be chosen from advertisers in this issue.

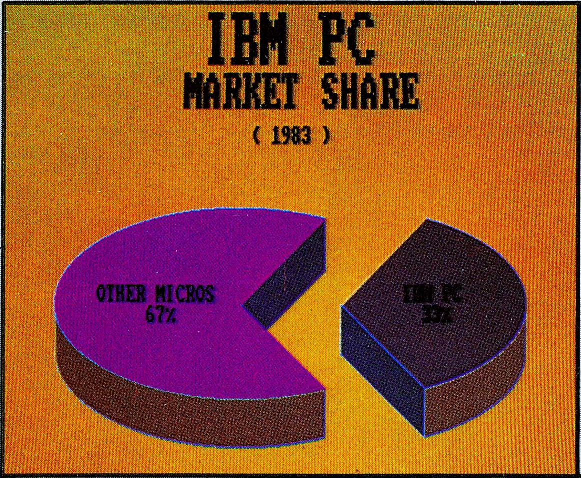


ACROSS CLUES

1. PURPLE DATA COMPANY
6. SALES REP: IAN
11. SNOW-DRIVEN INFORMATION COMPANY
12. ELITE DINER SOFTWARE
14. POPULAR STRUCTURED LANGUAGE
15. EXEC
16. HIGH-SPEED BUFFER MEMORY
17. POLICE DEPARTMENT WITH FIRST PC
21. BARNES, OUR COORDINATOR
22. DISNEY ENGINEERS USE IT
23. PASCAL SIGN OFF
24. SHE WRITES HALF A COLUMN
27. BOYD'S MONTHLY CHORE
28. COLUMN ABOUT WORDS

DOWN CLUES

2. DISK OPERATING SYSTEM
3. COMPANY GROWN FROM ACORN
4. LANGUAGE WITH FEMALE MONIKER
5. COMPANY THAT'S DOWN TO IT
6. READ-ONLY MEMORY
7. COMPANY WITH ZEN CONNECTION
8. COMPANY WITH PHONE-Y NAME
9. COMPATIBLE PORTABLE
10. SOFT BOOT FROM KEYBOARD
13. COMPANY NOT IN SICKNESS
15. TOP THIRTY
18. NICKNAME FOR IBM'S NEW BABY
19. A READY-TO-USE SYSTEM
20. BELL'S BABY
25. BLACK AND WHITE
26. TIM, ART ASSISTANT



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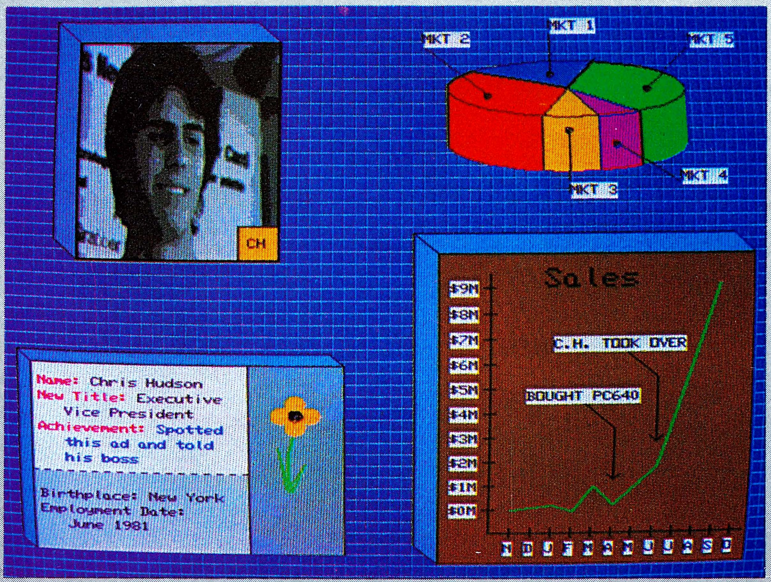

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crosstalk

A Call for Credit

Does anyone out there have a "Credit Union—Shares and Loans" program for the IBM pc? (Like a small bank statement program?)

Ronald O. Devrick,
Gillipolis Ferry, WV

And Now, for a Bow, to a Reader

I was happy to learn that my limerick was a finalist in your contest. There are a lot of frustrated writers in small college towns such as Laie, and it has been great sport telling them that I am now a published poet! Should my entry prove to be the ultimate winner, you might be interested in printing the following sequel:

Now the gorgeous young dataBase IIser
Thought the IBM user a loser.
Then he bought *1-2-3*.
She came over to see;
Now the loser successfully woos 'er!

Kenneth L. Lindsay, Laie HI

Speaking in Tongues

I was really impressed by the "Math Tutor" article written by Jean Varven in the July 1983 issue of *Softalk*. I have been looking for a good mathematics program for my seven-year-old and I think I have found it.

I also enjoy reading the monthly articles on the various languages. As a college student in computer science, I find them very informative as an extension to my computer courses. I am especially interested in Cobol, though. Is there enough interest in this language to run a monthly article as you do on Pascal?

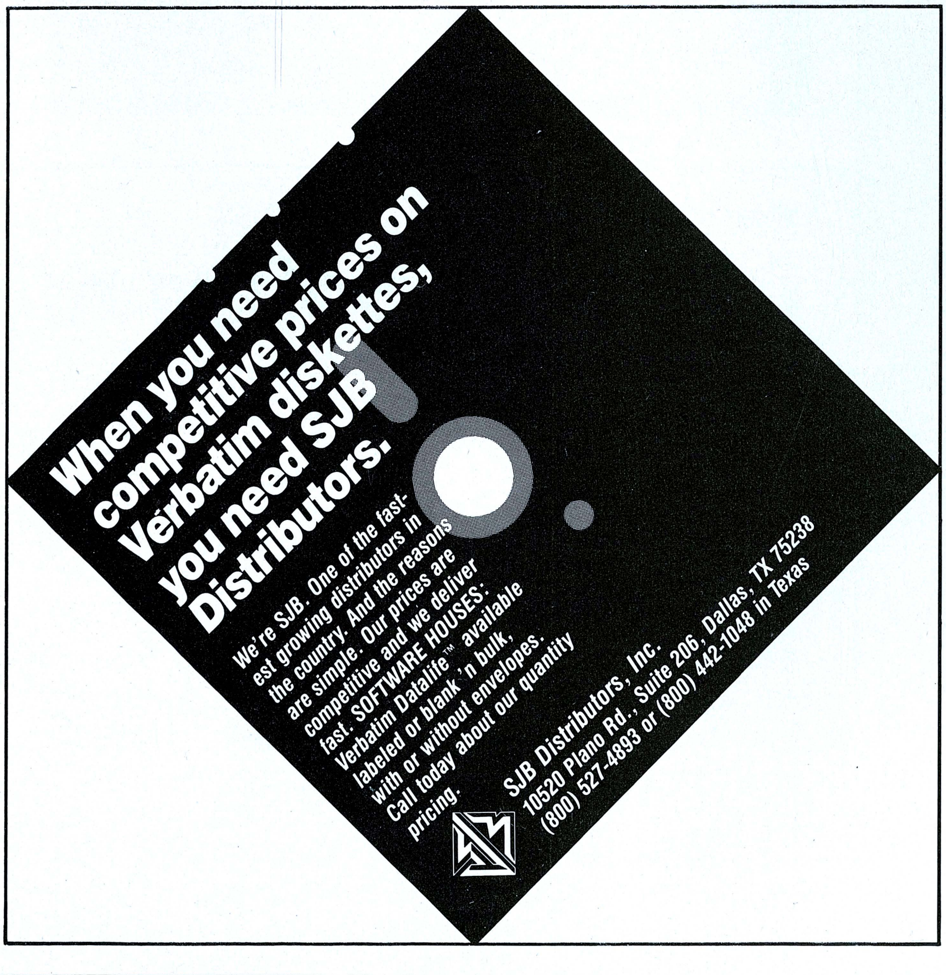
Randall W. Kempf, Santa Barbara, CA

Medical References Needed

I am currently a senior at Albany State University, studying biology and computer science. Your article "Software Physicians" was very interesting to me as I am hoping to enter into medical programming as a career.

The reason I am writing is to ask if you might have any helpful references from which I could obtain more information concerning computers in the medical field. As you stated in your article, not many doctors or even medical schools have yet incorporated computers into their work. For this reason it is difficult for me to research this field through readily available resources.

Lori A. Legault, Apalachin, NY



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Using Published Programs—A Clarification

I am writing as a representative of the Northwest Louisiana IBM User Group. In a recent meeting, a question that faces the entire computer community arose. While downloading programs from a nationwide "bulletin board," one of our members received a program he remembered seeing in a nationally published magazine. Since the purpose of downloading these programs was for inclusion in our club library, he rightly excluded this program until we could receive some clarification on this issue.

We discussed the issue in light of the published programs that occur from time to time in publications like yours. We feel as though the inclusion of these programs in our club library would greatly enhance our ability to support our members. We also prohibit the distribution of copyrighted material among our club members. We realize this question is multifaceted and cannot be fully addressed in this letter.

Three questions arise. Do you publish these programs for the private use of your subscribers or as programs for "public" use? If not for public use, would you grant permission to our user group to copy these published programs for distribution among our active membership? If we are granted this authorization, would you also grant us permission to include these programs among our listings on a "bulletin board," which our group sponsors?

As a user group, we find ourselves in a delicate situation. We want to support those who have recently entered the personal computer market as users. We also recognize and respect the professional organizations, such as your publication, which have developed in an attempt to serve the same group. We feel as though the stated use of the programs in question would allow us to support our members better and hence fulfill our purpose as a user support group.

We hope you will allow us to distribute these programs in the manner stated above. Know that our intention is not the generation of funds or profit but support for the user with a respect for the programmer.

Charles Walker, Elm Grove, LA

Thanks for giving us the opportunity to clarify. We emphatically encourage you to copy programs published in Softalk. *You may also print them in user group newsletters and list them on nonprofit bulletin boards. We'd like for them to reach as many people as possible. Technically,* Softalk *holds a copyright on everything published in* Softalk. *What this means in practical terms is that we'd take issue with anyone who chose to sell a program that we'd published, or print it, without our permission, in a book or a competing magazine. Apart from these limitations, please make free with our material in any way you wish.*

Diskette
DOS
A>
in A
Printer

```
* DOS likes to announce itself by typing A>. The cursor sits next to the >.
  This is called the "DOS PROMPT". When you see the DOS prompt you can count
  on this;

     DOS IS ALIVE AND IS PATIENTLY WAITING FOR YOU TO COMMAND IT.

● GIVE DOS YOUR FIRST NAME
```

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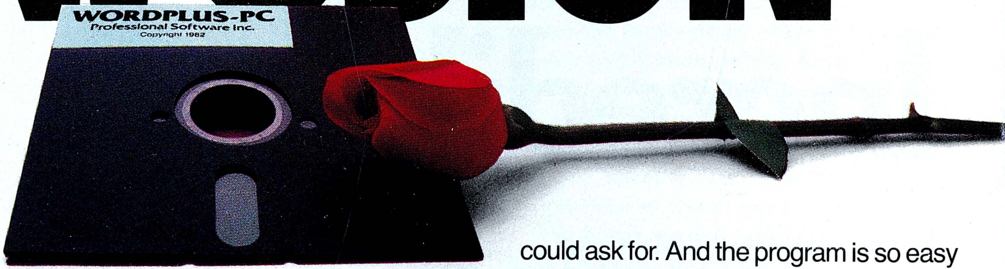


It's one confusing business, choosing a word processor. All those companies assuring you theirs is the most fantastic one of all. And leaving you to cut through all the smoke and hopefully whittle them down to the best one for you.

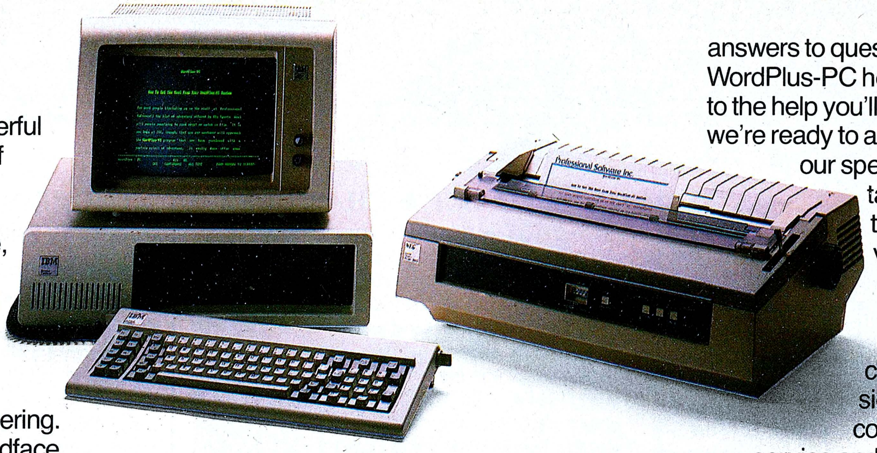
Well, we can help. If you'll just invest the next three minutes reading this, we'll tell you about a word processor that makes picking the right one a real breeze.

FIRST, A WARNING. There are two things you must do when evaluating any word processor. First, be careful. It's no secret that many of today's claims about being easy to learn and use just don't stand up to careful comparison. Watch carefully for complicated codes and programs that require "training sessions." Secondly, be selective. Buy a word processor you can use on a daily basis, not one that requires another "training session" when someone goes on vacation. In other words, be very careful to select the word processor that's absolutely the best and easiest to use. Which is what we'll now introduce you to.

WHY ONE WORD PROCESSOR MAKES THE MOST SENSE OF THEM ALL. Meet WordPlus-PC. It's the advanced, "user-oriented" software package that turns your IBM-PC computer into a word processor equipped with the sophisticated capabilities of far larger, more expensive systems.

THE REMARKABLE WORDPLUS-PC STORY. In a nutshell, it's this. WordPlus-PC was designed from the ground up to be the very latest in word processing technology. It has all the important features you could ask for. And the program is so easy to learn and use it defies comparison with other software.

HOW WE CAN BE SO SURE OF OURSELVES. We're Professional Software, a leader in word processing software with over 30,000 customers contentedly churning out letters and documents around the world on personal and business computer systems. We know precisely what a top quality word processor must do. And we've studied all the shortcomings of our competitors. That's how WordPlus-PC came to be the easiest-to-use word processor ever.



ALL THE FEATURES YOU'D EXPECT.

WordPlus-PC is both powerful and versatile. Its long list of major functions includes movement of paragraphs, global search-and-replace, and creation of multiple "boilerplate" and personal letters with the touch of a few buttons. There are 3-line headers and footers and automatic page numbering. When you underline or boldface words as you type, WordPlus-PC displays them in that form on the screen. You can merge information created by popular spread sheet programs. You'll create personal letters quickly and easily, or merge name and address information from other programs. You can easily create standard layouts for preprinted forms and use WordPlus-PC to prepare invoices or quotations. For large corporate customers, WordPlus-PC has the capability to merge information from files created by the firm's mini or mainframe computer. You can even type new documents while the system is printing other ones. And you'll find WordPlus fully compatible with virtually all popular ASCII letter-quality and dot matrix printers.

A BREEZE TO LEARN AND USE.

With WordPlus-PC's easy-to-use documentation, you'll be using your word processor right from the first minute. After an hour, you'll feel at home with all the basic functions and ready to explore the more sophisticated ones. After a few hours you'll put the manual away. There are never any complicated or confusing codes to memorize or look up. Rather, the screen's "message area" reminds you how to do what you want. WordPlus-PC's unique keyboard color coding makes things even easier. And whenever there's a question, simply press the HELP function to get back on track.

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ProKey/Scrollk Solutions

This letter is in response to the "Crosstalk" letter in your July issue of *Softalk* entitled "A Solution to Scrollk.com vs. ProKey."

As was mentioned in that letter, *ProKey* does not work with Scrollk.com. RoseSoft does offer a new version of *ProKey* called version 2.2 that will work. The updated version costs five dollars, however; RoseSoft is going to release an even newer version called *ProKey Plus* this spring. I have thus decided to save my five dollars to spend on *ProKey Plus* and have devised two short programs that will enable the current version of *ProKey* to work with Scrollk.com.

The problem lies in the fact that both programs use the same interrupt. I have written two six-line programs that reset the interrupt vector locations in memory. The first program I use before installing *ProKey* and the second program I run after using *ProKey*.

The first program I call Preproky. The listing follows:

```
10  DEF SEG=0
20  POKE &H40,A   : POKE &H41,B
30  POKE &H42,C   : POKE &H43,D
40  POKE &H58,W   : POKE &H59,X
50  POKE &H5A,Y   : POKE &H5B,Z
60  SYSTEM
```

To determine the values of A–D and W–Z, first load all the .com programs you intend to use including any RAM spoolers and/or print spoolers. Then load *ProKey*.com but *not* Scrollk.com. Then use the Debug program by typing *Debug*. Once in the Debug program, you should see a dash (–). Type "D 0000:40". A listing of the contents of absolute memory locations 00040 through 00060 will show on the screen. Copy what is in locations 00040–00043. These values should then be substituted for the values A–D in the above program. Then copy what is in locations 00058–0005B. These values should then be substituted for the values W–Z in the above program.

The second program I call Postprok. It is the same as the Preproky program except the values of A–D and W–Z are different. To determine these values load Scrollk.com (now both Prokey.com and Scrollk.com are in the system), then enter Debug again and again type "D 0000:40". The contents of locations 00040–00043 become the new A–D and locations 00058–0005B become the new W–Z.

You now have two basic programs. The way I use them is that I first rename the Prokey.com program as Prokey1.com. I then call Prokey1.com followed by Scrollk.com in my Autoexec.bat file. I then have a second batch file called Prokey.bat. To enter this file type:

```
Copy con: prokey.bat
basica preproky
prokey1.exe %1
```

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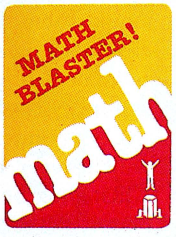

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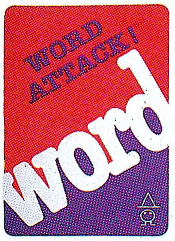

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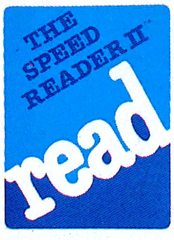

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```
basica postprok
<Control-Z>
```

Now whenever you want to change the file being used by *ProKey*, just type it in as you would normally. For example, to clear *ProKey's* memory, type *Prokey /C*, or to enter a new file (such as one called Basic.key), type *Prokey basic.key/r*. The batch file just created will then be invoked by the system and the parameters typed in after the name of the batch file (Prokey) will be substituted for the %1 in the batch file. If you have a compiler, both programs can be compiled; or better yet, if you have an assembler, these two programs are both trivial to write in assembly language.

Michael Rudolph, M.D.,
San Francisco, CA

Further to the letter by Mr. Bremer in your July issue concerning the problems in running both *ProKey* and Scrollk together, I offer the following. If you don't want to pay the extra five dollars for the modified *ProKey*, this patch will allow us ". . .pcers to have our cake and eat it too."

First a prologue on how programs such as *ProKey* and Scrollk work. Mr. Socha very ably describes the process by which Scrollk is *"installed"* as an extension to DOS. Specifically, it modifies the keyboard interrupt vector to point to the Scrollk routine (retaining the old vector address) and issues an *INT 27H* to allow the program to remain resident in memory. This program then acts as a front-end "sieve" that screens all keyboard input before transferring control to the actual interrupt handler (via the old vector address). (For more information on this technique, refer to Mr. Socha's article or to Tim Field's more detailed description in the March 1983 issue of *Byte* entitled "A Peek into the IBM PC.")

ProKey uses the same approach. This should not matter, for as long as any program that modifies an interrupt vector to point to itself transfers control to the routine pointed to by the old vector when it's finished, we should be able to chain as many programs as we like. So, in theory at least, we should have no problems running both *ProKey* and Scrollk; and in fact the two do run well together as long as you don't try to modify the *ProKey* buffer.

The problem here arises from the fact that *ProKey* was written to be very flexible, a fact that I believe most users of this excellent software will attest to. But this flexibility is unfortunately restricted by DOS. For although DOS will allow you to install a program in memory, it does not recognize it's there! All it knows is that the memory your program occupies is reserved and is not to be overwritten when loading other programs. If you want to activate your program with a variable command line, there is no way of getting direct access to it from the DOS command level. You are thus forced to load and execute a new copy of the program to perform such tasks. This entails several problems. Namely, the program will try to install itself again if not told otherwise. This would be very wasteful, since each time you allocate memory in this manner it stays allocated until you reboot the system. You could run out of memory very rapidly, especially if you have only 64K. Another problem *ProKey* faces with this approach is how to let these nonresident copies of the program access the memory-resident *ProKey* buffer—how do they know where it is in memory?

First of all, how does *ProKey* know when it should or shouldn't be installed? Very simply, it assumes that the vector address being replaced is the one IBM intended to be there (that is, the one pointing to ROM). This pointer must have a segment address of F000H (all the ROM routines have this segment address). Thus if the old vector points to ROM, it merrily proceeds to install itself. If any other segment address is present, it assumes that *it* has already modified this location and is thus already installed. All our problems arise from these assumptions! Given that *ProKey* assumes that no other program has modified the keyboard interrupt, for everything to work properly we can simply install *ProKey before* Scrollk in your Autoexec.bat file, thus assuring that *ProKey* will see what it expects for the keyboard interrupt vector. This should solve all of our problems, right? I'm afraid not. Even if this did work, Scrollk would be left in limbo when you performed a *Prokey/q*, since this restores the original ROM pointer, effectively bypassing Scrollk! However, there is a far greater problem in installing Scrollk after *ProKey*. As I said before, the assumption *ProKey* makes if the vector does not point to ROM is that it has modified this pointer and is now resident at the new pointer address. In addition, *ProKey* maintains an in-core buffer for all the key assignments you have made. Thus, knowing the relative offset of this *ProKey* buffer, it assumes it can compute the absolute memory location of the buffer from the interrupt vector address plus this offset (this is *not* good programming!). However, Scrollk has modified this pointer so what *ProKey* is actually looking at is the code for Scrollk and beyond. Now any *ProKey* command involving manipulation of the *ProKey* buffer, especially the clear command, will bomb the system, since it will inevitably corrupt the Scrollk code!

So what to do? If we install Scrollk before *ProKey*, *ProKey* will never load, since it will think it has already been installed (and will corrupt Scrollk with any buffer initialization files you may have invoked on the command line); and similarly, if we install Scrollk after *ProKey*, any subsequent buffer commands will also corrupt Scrollk.

We *must* have the interrupt vector point to the *ProKey* code since no buffer commands could be issued otherwise. This means installing *ProKey* last, after Scrollk. However, if we install Scrollk first, we will have already modified the interrupt vector and *ProKey* will not install. This is where we do a little creative patching to *ProKey*. There is a location in *ProKey* that contains the F000 address used in the check described earlier. What if we changed this location to contain instead of the ROM segment address the Scrollk segment address? Then *ProKey* would effectively make its criterion for installation whether Scrollk had been installed rather than whether the vector was still pointing to ROM. The following describes how to do this. The actual segment address will vary depending on your operating system and/or whether you have other programs installed in memory.

Format a new system disk (*Format/s*) and copy Debug.com and Prokey.exe onto it. Boot your system from this disk. Enter Debug and examine the registers with the R command (see your DOS manual if you are unsure). After Debug displays the registers, it will then print the segment address and offset of the current instruction in the form xxyy:0100. This actually points to the first available segment in memory and is in fact where Scrollk will be installed. The first four digits before the colon (:) are the segment address. Write this number down. Now do the following:

```
A>COPY PROKEY.EXE PROKEY.PAT
```

This will make a copy of *ProKey* that is patchable (.exe files are not). Now enter Debug again and do the following:

```
A>DEBUG PROKEY.PAT
    -<D CS:2A63 L2>
    ####:2A63 00 F0
    -<E CS:2A63>
    ####:2A63 00 <yy>
    -<E CS:2A64
    ####:2A64 F0 <xx>
```

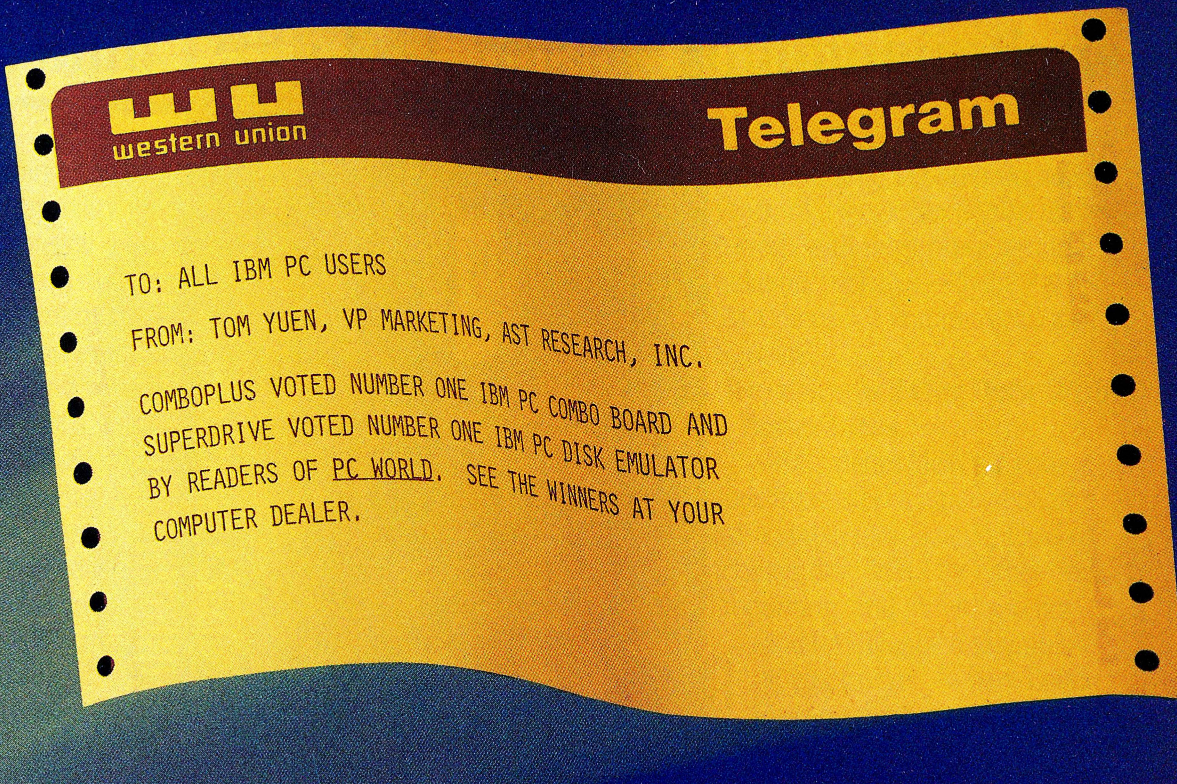
The < > are to indicate your entries—you do not actually type them. The numbers <yy> are the last two digits of the segment address as determined above, and <xx> are the first two. Then:

```
    -<Q>

A>COPY PROKEY.PAT PROKEY.EXE
```

You must then create an Autoexec.bat file that installs Scrollk before *ProKey*. If everything works fine, copy the new .exe file onto your working disk. If not, you have probably made an error and should carefully review the above procedure.

A word of caution: The above procedure describes what to do to install *only* Scrollk and *ProKey*. If you need to install other programs before Scrollk, be sure to do so before computing the segment address for the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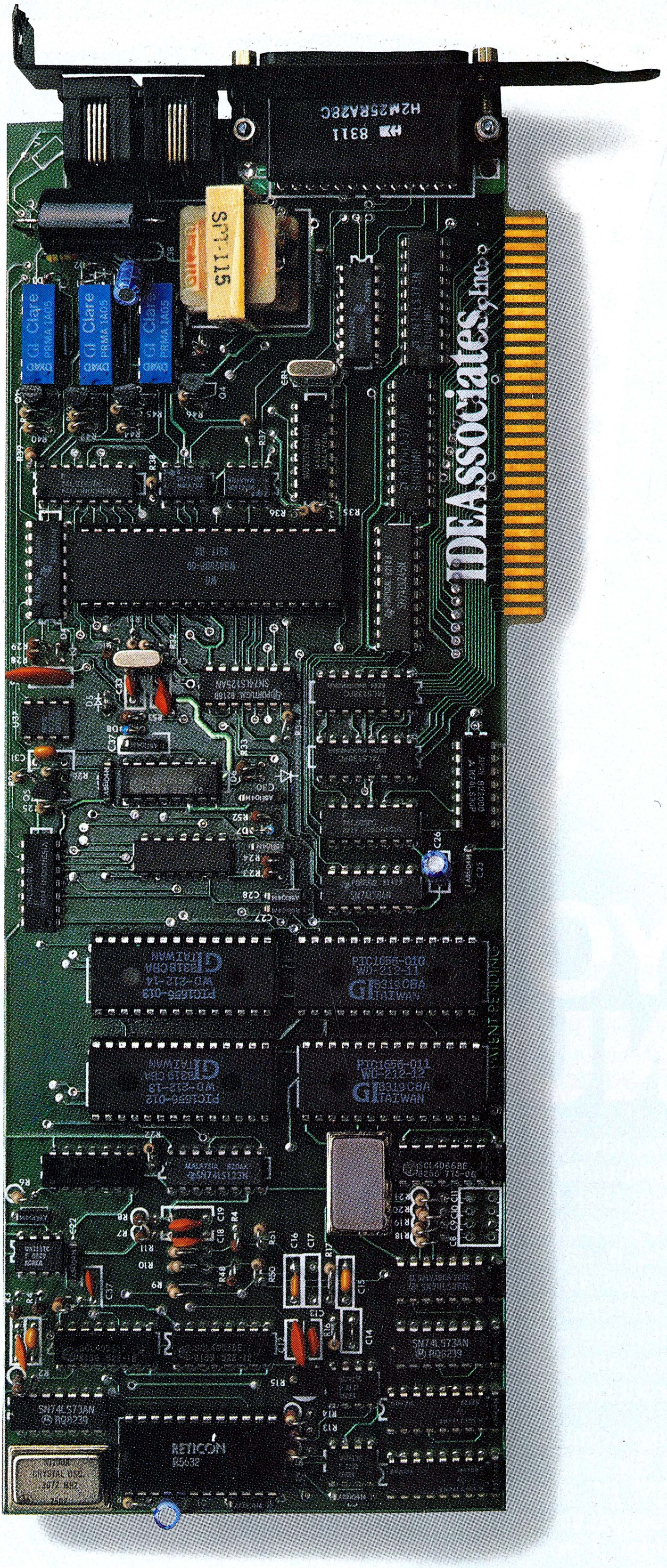

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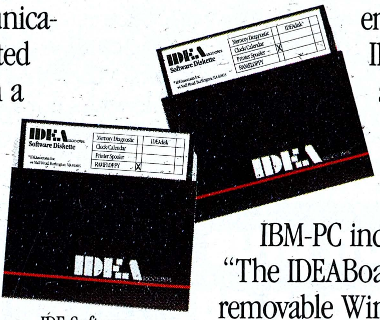

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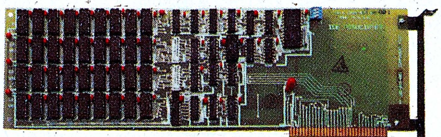

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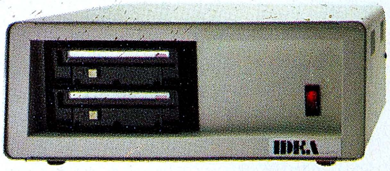

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Fulvio Castelli, Montreal, Canada

Outstanding in His CkField

I was particularly impressed with the programs listed in the April and May issues of this year, "CkKey" and its final form—"CkField". They have proven most useful, and I plan to implement them in a home finance program I'm currently working on. I did have one problem with the program and wanted to tell you about it.

Mr. Juhasz's "CkField" included the ability to use the tab key to signify that the enter key had been pressed. This is particularly useful with a multifield screen to allow the user to skip from field to field with the tab key, capturing the data entered along the way. However, after setting up my program to pass the correct parameters to the routine (allowing for numerals and a slash character with Minkey=47 and Maxkey=57), I found that hitting the tab key was not accepted. Instead I got the mellow tone of *sound 50,4*. Examining the code in CkKey, I found that the tab was not checked for—it isn't till we get to CkField that we check for Rtab$ or Enter$ (variables set up that contain the ASCII values for the tab and enter keys). The only way we can get to CkField with the tab key is by allowing for the tab key in the minimum/maximum check, or by setting up a special allowable key with the Lkey$ variable. This was too much effort for me—in my application, I want the tab key to always be allowed to signify that the field has been entered. So I made the following change to CkKey:

```
5150  IF CKFIELD.SW AND
      (CK$=ENTER$ OR
      CK$=BKSPC$) GOTO 5310
```

Change to:

```
5150  IF CKFIELD.SW AND
      (CK$=ENTER$ OR
      CK$=BKSPC$
      OR CK$=RTAB$) GOTO 5310
```

This change allows CkKey to branch to CkField every time the tab key is pressed. CkField then tests for the tab or enter key being pressed, and recognizing it as such, will process the field and return to the caller.

I hope this change will be useful to other users. I especially want to thank Joe Juhasz for such an excellent tool. I hope to get very good use from his routines. They are definitely a wanted addition to any user-friendly, professional program that requires data entry from the user. (In other words, almost every program!) Thanks again for putting out such a quality magazine—it shines above the ad-bound masses.

Scott Rohling, Nederland, CO

Of pcs and MDs

I read your article recently in the July issue of *Softalk*, called "Software Physicians—PCs Join the Johns Hopkins Staff."

I am researching the use of the IBM XT for medical purposes, primarily in a doctor's office or hospital/clinic/lab settings. I have been searching mainly for a complete doctor's office package for patient records, insurance billing, and so on. But I also am fascinated by Dr. Johannes's and Dr. Ravich's innovative developments in medical computer programming. Although their work is in its incipiency, I would like very much to learn more about it. Also, the computer networking of medical information between institutions is a fantastic possibility about which I would appreciate receiving any more detailed information.

The computer's application to the medical field is such an exciting development. I look forward to hearing about any software possibilities and how I can find out more about them.

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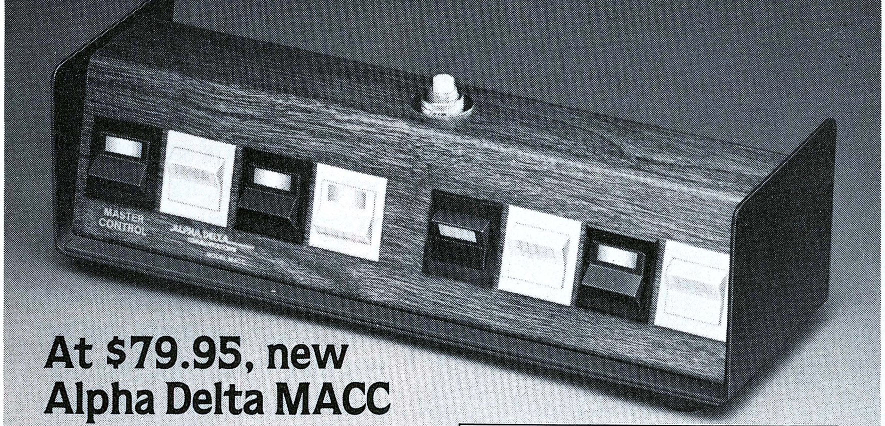

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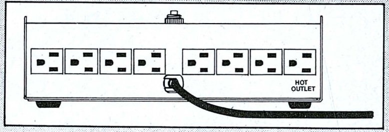

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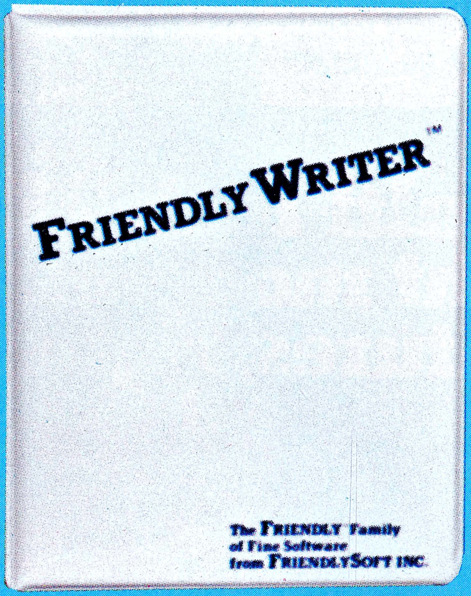

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No More Articles of War

I want first of all to express my appreciation to you for producing such a fine magazine for the IBM pc. There is certainly no shortage of magazines dedicated to the pc, but yours seems much more involved with the *user* rather than the gadget dilettante. With this in mind, I must tell you that I find the inclusion of certain of your articles difficult to understand or justify, because they seem to conflict with what seems to be your basic aim in helping such end users.

I am especially concerned with such articles as the one on the Alaskan Defense Network in your June issue. I am not quite sure as to what this article really means to communicate to pc users. I was aware that computers of several types are used in such applications before I read the article. If pcs are used as well . . . so what? I doubt that many of your readers plan to install their own warning networks and I would hope that most have gotten to the point of realizing that it is time to devote some thought to *dismantling* such systems rather than glamorizing them as some sort of super gadgets! I for one feel very uncomfortable at the thought of what could happen at almost any time should one of these "Super-pcs" crash in the "attack mode"!

So please, give us more fine articles, patches, and reviews and keep the "war games" in the arcades!

Peter Feldman, Santa Barbara, CA

Pascal B to E—In Its Own Write

I am a subscriber to *Softalk* and an avid reader. Your publication is the only one of the several I receive that I read cover to cover. I especially appreciate the column by Bruce F. Webster and Deirdre A. Wendt on Pascal. Their clear, concise, and comprehensive coverage of this language has been an invaluable reference to me since the column started.

I have recently written to the two authors and have learned of the plans to publish the columns in book format. I think it would prove to be one of the top publications on the language and look forward to seeing it in print soon.

Patricia Lynch, Analytical Numerical Systems, Inc., Saunderstown, RI ▲

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WINNERS

Dear Contest Editor:

I have had a lot of fun (?) working on your June Jumble. Thanks to you, my eyes are weak, my back is bent, my nerves are shot, and my wife is threatening to stop my subscription to your magazine! In any event, my congratulations to those devious characters that dreamed up this insidious contest.

I would like to make four technical points on your Jumble: (1) The word "PRINTER" does not exist—"PRINTEC" does. (2) The word "PALANTIR" does not exist—"PALANTIN" does. (3) The answer for #16 could be "TRADE" or "CROSS". (4) Whoever suggested putting the 2 & 3 after the "I" should be caged!

Thanks for a lot of fun (you rats!). . . .

Our reply to Robert C. Seelbach (Lexington, KY): (1) Correct. (2) Correct. (3) Or even "SOF". (4) The contest editor has always been caged.

The above correspondence was only one of several stinging letters we received regarding the typos in our June contest. We apologize profusely and have held none of them against you.

The winning Level 2 bombed out a few entrants at two points. In clue #10, *T.I.M.* is not your innovative guide, Amdek is, according to its slogan. In #17, Digital makes *Perfin*, which is the answer to clue #9.

The random-number method picked Becky K. McMennamin as our $100 Level 2 winner. For the bonus $50 for Level 3, we had to resort to the trusty random-number method again, because of the landslide of one- and two-hundred-word, computer-generated lists. We have created a monster! The Level 3 winner is James R. Millikin (Rockford, IL). ▲

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QUESTIONS & ANSWERS

by Nancy Andrews

Q: I have an application for which I wrote a program that evaluates many variables and returns an answer. With each pass through the program, the variables must be evaluated with one of many different formulas. Because of the nature of the application, it is often impossible to predict which specific formula will be needed.

Up to now it's been a very simple matter for me to predetermine which formula to use and write it in as a line of Basic code. However, others will now be using the program, and most of them have little knowledge of computers, let alone of Basic. I have considered using a menu system to select the appropriate formula, but because of the large number of formulas involved, it becomes a very tedious chore to pick the right one from many screens of long formulas. It is also no piece of cake to write all of the conditional branch routines necessary to implement such a menu-driven system, and doing so would multiply the length of the program by the number of formulas required to cover all cases, which could number into the hundreds.

Unfortunately, the nature of the application requires a custom-written program, so other commercial programs have been ruled out. What I need to be able to do is to have a line that prompts the inexperienced user to enter the appropriate formula. As far as I have been able to determine, IBM Basic does not provide a way to input a formula into a running program that can then be used later in the program. Is there a way to do this?

Randolph R. Madera

A: Here's a way:

1. Get the formula from your user as a string variable. For example:

```
Input A$
```

2. Make the string into a complete line of Basic code:

```
A$ = "1000 DEF FNF(X,Y) =" + A$
```

3. Write A$ out to a file called Formula.bas.

4. Use the *chain merge* command to incorporate the formula into your program.

Here is a sample program that shows you how this works.

```
10  PRINT "ENTER A FORMULA"
20  INPUT A$
30  REM change A$ to a complete line of Basic code
40  A$ = "100 DEF FNF(X,Y) =" + A$
50  OPEN "FORMULA.BAS" FOR OUTPUT AS 1
60  PRINT #1,A$
70  CLOSE #1
80  CHAIN MERGE "FORMULA.BAS",90
90  REM this line is here only for continuing the chain
200  PRINT FNF (10,11)
300  END
```

If the user's formula were X*X*X*Y and the function called with the values in line 200, line 100 containing the formula would be inserted in the program and the function would return the value 11,000.

Q: Are there any software packages currently available for the IBM pc that can handle manufacturing inventories, including costed bills of materials? Every month I scour your magazine looking for a package my company could use.

Daniel P. Carroll

A: We found two companies that have pc software capable of handling inventories and costed bills of materials. They are:

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Pasadena, CA
(800) 221-1985

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The other company is:

Occupational Computing Company
Woodland Hills, CA
(213) 999-1919

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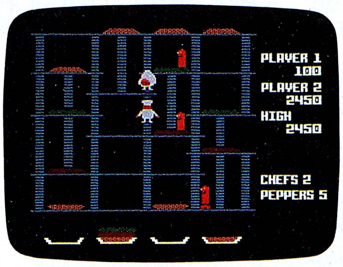
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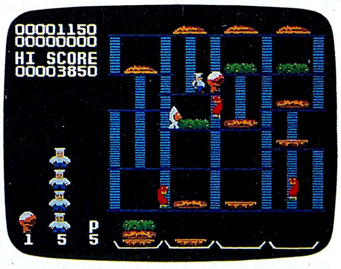
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Q: I have an Olivetti ET121 electronic typewriter equipped with a TP121P Vertical Data Systems interface connected to an early model pc via the monochrome/parallel interface board. I have no problem with the printer when operating from *WordStar* or C 1.00, but the *lprint* statement on disk Basic 1.05 and 1.10 prints one letter, and then a device fault statement occurs. I tried John Socha's Printfix in the March 1983 *Softalk*. Unfortunately the problem still exists. Can you offer a solution or point the way to a solution?

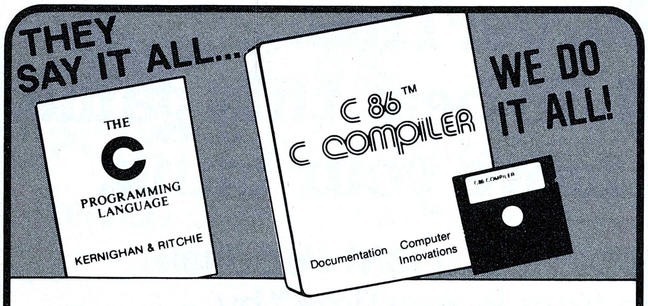
Howard Epstein

A: Have you been running Socha's Printfix program each time you reboot DOS? If you're using Printfix with Lpt1, there is no way Basic can return a "device fault" message. Run Printfix each time you reboot DOS, and let us know if you still have the problem.

Q: I hope you can help me with some very sticky and troublesome technical problems. Some time ago I was toying with the idea of calling machine language subroutines from Basic. Since I have 128K, I chose to load the subroutine in the uppermost 64K of my machine, beginning at location &H10000 (*def seg = &H1000*).

After having all sorts of bizarre and erratic results with this approach, and after many hours of experimentation and tinkering, I began to suspect that Basic (and/or DOS) was randomly clobbering storage in the uppermost 64K of my machine.

As if this weren't bad enough, it seems that if you use certain memory locations within the uppermost 64K from within a Basic program, Basic itself gets confused and enters the twilight zone. For example, I tried a simple Basic routine that poked a value into each memory location beginning at &H10000 and continuing through the last available byte of storage. After executing awhile, Basic issued a garbled message and died. Attempts to do anything other than power the machine off were unsuccessful.



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I still have DOS 1.0 and single-sided drives. However, some rudimentary checking on other machines and configurations seems to indicate that the problem is universal.

Are you aware of the symptoms I have described? If so, do you know of any way in which machine language routines may safely be loaded into the uppermost 64K of a 128K machine? I have already attempted to get a response from IBM regarding this problem and have thus far been unsuccessful.

Larry Ellis

A: The problem you are describing occurs because you are putting your assembly language subroutine between your Basic program and the stack. When your program runs and the Basic stack grows, it clobbers your subroutine. The misconception seems to revolve around where the Basic stack begins. If that can be determined and the assembly language subroutine loaded above that point, nothing Basic does will touch the subroutine.

To determine the starting point of the stack (using a 128K machine), we wrote a short subroutine to access Basic's data segment. This is the data segment for the Basic interpreter and contains:

- the Basic Interpreter's variables
- the user's Basic program
- the user's variables
- Basic's stack

Here's the Basic version of the subroutine we used:

```
10   DEF SEG = &HB000
20   A = &H2
30   FOR ADDRESS = A TO A+&HF
40             READ CODE
50             POKE ADDRESS, CODE
60   NEXT ADDRESS
70   I%=0
80   CALL A(I%)
90   PRINT HEX$(I%)
100  END
1000   DATA &H55
1010   DATA &H89,&HE5
1020   DATA &H8B,&H76,&H06
1030   DATA &H50
1040   DATA &H8C,&HD8
1050   DATA &H89,&H04
1060   DATA &H58
1070   DATA &H5D
1080   DATA &HCA,&H02,&H00
```

As you can see, we ran this at an arbitrary safe starting place, B000. With DOS 1.0 it returned the value 69C, with 1.1 it returned 6C0, and with 2.0 it returned D16; you will get similar, though possibly not the same, numbers. We then added 64K to get beyond Basic's stack, made that address the beginning of our segment, and loaded the subroutine beginning at that point. To do this we changed line 10 from *def seg = &HB000* to *def seg = &H169C* (or 16C0 or 1D16 for DOS 1.1 and 2.0 respectively; substitute the number you get when you run the subroutine). We then ran the program at this location. Next, we exited Basic, reloaded Basic, and called the same subroutine, but without lines 30 to 60 and lines 1000 to 1080. It worked correctly, indicating that our subroutine, when loaded at the address calculated, was not clobbered when Basic was loaded. Run the subroutine on your own machine loaded at or above 64K plus the number returned by the subroutine.

If you use /M, /C, or /F when you load Basic, this number will change, based on the value following the M, C, or F. ▲

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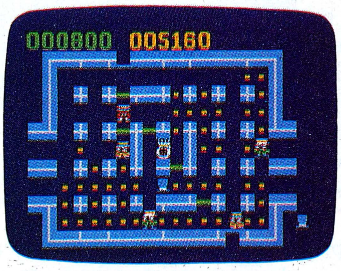
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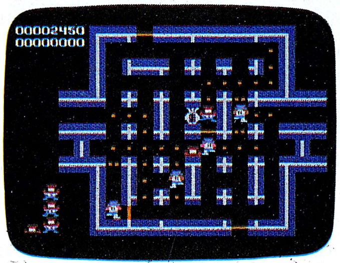
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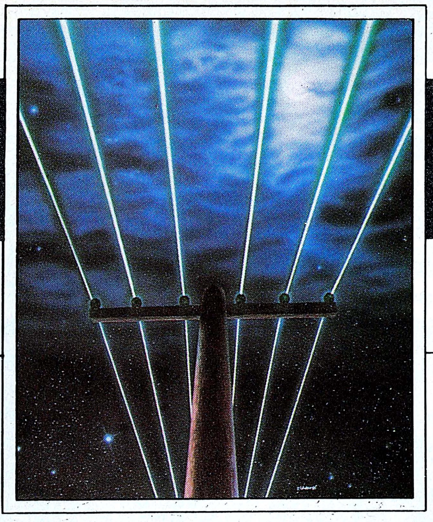


COMM LINES

by Kevin Goldstein

The Makings of a Modem

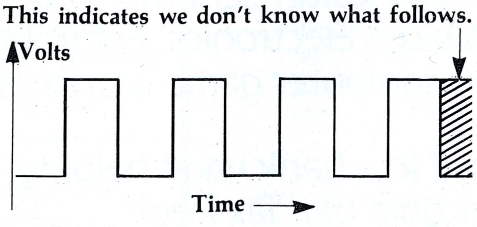
Last month we took a look at some of the obstacles encountered when digital computer signals are sent through an analog transmission medium, such as the phone line. In particular, we saw that a telephone line's information-carrying capacity is finite, limited at the top by the maximum frequency it can pass and at the bottom by the minimum frequency it can pass; the band of frequencies between those two that a channel can pass is called the *bandwidth*.

The bandwidth of a phone line is a little shy of 3000 Hz (cycles per second), running from about 300 Hz at the bottom end to 3000 Hz (3 kHz) at the top. Any attempt to pass a signal outside this range will result in either significant distortion of the signal—what comes out will be drastically different from what goes in—or simply no signal at all. We also saw that there is a limit to how fast a signal meant for the phone line can change; phones prefer smooth, sine-wave-type signals to rapidly changing, on/off-type digital signals.

By now we can see that putting our digital data on the phone line is no easy task. We need a way of encoding the data so that no matter how fast or slowly we send it (within certain limits, of course), the frequency of the signal on the phone line stays within a fairly small range. Let's see if we can come up with a workable encoding scheme that meets these demands.

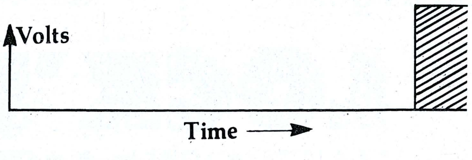
To start with, we know that the phone line prefers a sine wave, so let's try to convert our data into a sine wave. One fairly simple solution would be to pick two different frequencies within our allotted bandwidth (300 to 3000 Hz) and let one of them represent a digital 1, the other a digital 0. For example, let's say we can magically generate a 1000 Hz sine wave and turn it on and off whenever we wish. Let's turn the 1000 Hz tone on when we have 0 to send and off at all other times. (For the rest of this series, an unadulterated sine wave signal suitable for transmission over the phone line will also be referred to as a *tone*.) Let's also use our newfound magical powers to generate a 2000 Hz tone, which we'll let represent a 1.

So far so good: Turn on the 1000 Hz tone when we want to send a 0 data bit, and turn that off and the 2000 Hz tone on when we have a 1 bit to send. Now, just for convenience, let's suppose we have a computer that spits out data at only 100 bits per second. (That data rate, while it sounds slow in terms of the 300- and 1200-bit-per-second data rates so common today, is quite close to the 110-baud rate of the once ubiquitous Teletype.) Let's find a good character to send for our examples: How about an asterisk, * In ASCII, an asterisk has the decimal value 42, which is 0101010 in binary—alternating 1s and 0s, starting with a 0 bit. That's similar to the pattern of the character we used in last month's column, an ASCII U, which also had an alternating sequence of 1s and 0s, but started with a 1. A timing diagram of the transmission of the ASCII character * would look like this:



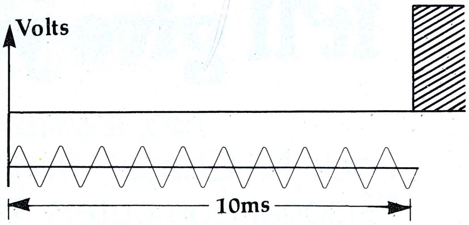
We'll see later why a repeating character like this is an especially good one for examples and testing.

Let's draw a timing diagram of what our signal might look like on the phone line, using the encoding scheme we just dreamed up. To start with, there's nothing on the phone line:



Note that this time we're going to think of our signal in terms of voltage rather than current. Voltage is the electrical unit by which interfaces are usually specified, and as long as the resistance doesn't change, the resulting diagram will look the same as if we had used current.

Now the first bit, a 0, is ready to go. If we're transmitting data at 100 bits per second, then it must take 1/100 of a second to transmit a single bit; we could call 1/100 of a second one *bit time*. The 1000 Hz tone that we're using to represent that 0 bit changes ten times as fast; it takes only 1/1000 of a second to send a single cycle of the 1000 Hz tone. A thousandth of a second is called a millisecond, abbreviated ms, and written 1 ms. Expressed in milliseconds, our example is using a signal with a bit time ten milliseconds long. Let's draw a timing diagram showing the transmission of our first bit:



This diagram is actually two separate graphs sharing a common axis. The upper figure shows the data bits that we wish to send; the lower figure shows how those bits would be encoded. The upper figure, then, represents what might be coming from our computer, whereas the lower figure is the resulting signal that would be coupled to the phone line.

As you can see, during the time it took to send one bit, 1/100 of a second, there was time for ten cycles of the 1000 Hz tone.

Now let's draw the next bit, a 1. We're going to represent that by a 2000 Hz tone. A 2000 Hz tone has a period of .5 milliseconds—that is, it takes it .5/1000 seconds for one complete cycle. That means we'll have twenty cycles of the 2000 Hz tone during a bit time:

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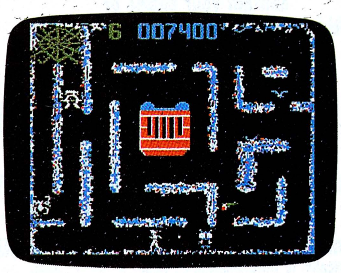

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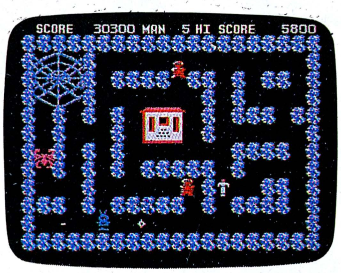
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*Jerry Pournelle, *BYTE Magazine*, April '83, p 234.

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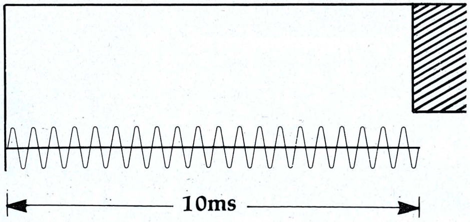
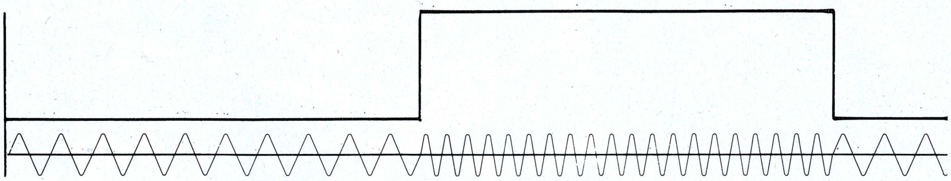


The rest of the character we are sending is simply a continuation of the alternating 0/1 sequence we started above, so if we send the whole character, we'll create a signal, the first few bits of which look like this:



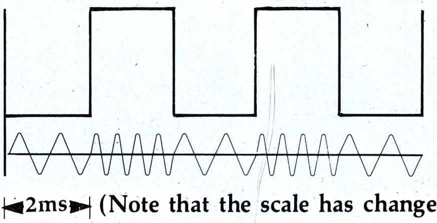
Incidentally, it's all well and good to say "The signal would look like this," but you might be wondering just what that means in real life. In this case, it means exactly what it says: If we actually generated the signal shown above, we could "look" at it with an oscilloscope, a wonderful instrument that draws a picture on a CRT of a voltage at any given instant in time. An oscilloscope simply yanks a bright dot across the CRT face from left to right at a constant rate; the voltage under test moves the dot up and down, thus creating a picture on the CRT like the one above. The picture is sometimes referred to as a trace; many scopes are capable of displaying two or more separate signals at once, producing a dual trace picture that looks just like the ones we've been drawing here. Just as with your video display, the picture must be constantly refreshed, or it will fade. That's why a character like the asterisk is a nice one for test work; it keeps repeating the same pattern on the scope face. The timing diagrams we're talking about are what you would actually see if you had an oscilloscope to work with.

Now that we know what our timing diagram means in real life, let's get back to it. Will our hypothetical scheme work? Let's see if it solves the problems.

First off, the only kind of signal we'll be putting on the phone line is a sine wave, which has no fast rise times; that obviously takes care of one problem. And even if we're sending only one bit per second, the lowest frequency we'll ever put on the line is still 1000 Hz—at slow data rates, we'd simply alternate between the two frequencies at a lower rate. That takes care of the second problem, the minimum frequency constraint. And it would appear that the final problem, the maximum frequency constraint, may also be taken care of: No matter how fast our data rate, the highest frequency our phone line will ever see is 2000 Hz. At high data rates, we simply alternate between the low and high tones at a faster rate.

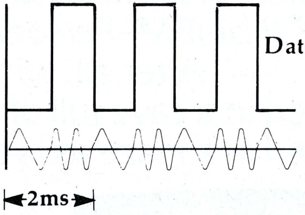
Things look good. Too good. While it's true there's no lower limit to the data rate, can it really be true that there's also no upper limit? That sounds suspiciously close to perpetual motion, money trees, and free Haagen-Dazs—too good to be true. Let's see what happens at high data rates; we'll start by drawing a timing diagram of the transmission of our old favorite, the character U, at a 500 Hz data rate.

Data rate=500Hz.



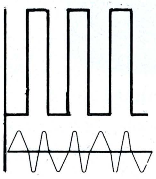
(Note that the scale has changed.)

Hmm. Everything looks okay. It's true there are fewer cycles of the 1000 or 2000 Hz tone each bit time than there were at the 100-bit-per-second rate, but it's still pretty easy to count the peaks or zero crossings of each wave during a single bit time, and thus to distinguish the 1000 Hz signal from the 2000 Hz. Let's double the data rate again, to 1000 Hz.



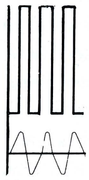
Data rate=1000Hz.

Well, we're probably okay; it still doesn't look to be too hard to distinguish the 1000 from the 2000 Hz tone. Let's double again, to a 2000 Hz data rate:



Data rate=2000Hz.

It's getting somewhat difficult to visually distinguish between the two signals, although it's probably still possible, assuming our electrical circuits can tell one frequency from the other as well as our eyes. Let's double the bit rate again, to 4000 Hz:



Uh oh, Amos, we've got a problem. What do we count here, peaks? Zero crossings? This is a mess. It's certainly not that easy for our eyes to tell one frequency from another, because there aren't enough cycles per bit time; it's no easier for electrical circuits to make the distinction, either. And, of course, the problem gets even worse as the bit rate gets faster yet: There are progressively smaller fractions of a complete cycle in each bit time, which makes distinguishing one frequency from another quite beyond our magic.

Just how fast *can* we send data? Well, it's obvious that the higher the frequency we use to represent the data, the more cycles of it we'll have in any given period of time. Assuming it takes a minimum number of cycles to accurately decode a frequency, which certainly seems to be the case from the preceding illustrations and is indeed the case in real life, it follows that higher frequencies can be decoded faster, which means we can move from a 1 to a 0 faster. Put another way, the higher the frequency, the faster the bit rate it can support. We'll look later at the limits to maximum bit rate; for now, suffice it to note that it's the 1000 Hz frequency that first limits the bit rate in our example.

A scheme like the one just mentioned is very workable (at least at relatively low data rates) and has the very compelling advantage of being simple and therefore inexpensive to implement. As a matter of fact, the modems used by the Teletype Network of the Deaf employ a similar scheme.

There's no free lunch, though, and the aforementioned scheme does present some problems. One of those problems has to do with the way *gain* (volume) is controlled on the telephone line. Phone circuits have what are known as automatic gain controls; that is, they amplify quiet signals more than loud ones. If they didn't do this, you might find that one time a friend's voice could come across the line so quietly you'd have to strain to understand him; at a later time and with a different physical connection, his voice might be so loud you'd have to hold the receiver at arm's length. While these gain controls are useful in voice circuits, they present a problem for our little modem circuit: If there are any long periods of quiet when no bits are being sent, the automatic gain control (AGC) would turn up the gain full blast. Otherwise quiet background noises would then be magnified to the point where they would be quite easy to ascertain, both by ears and by modem-receiving circuits. If any of those noises happened to be near one of the frequency bands our modem is using, a not unlikely possibility, our modem would erroneously decode it as data.

That's one problem; another is this. Suppose we had asked a remote computer to download a long file to us. After the transmission of the file has started, we realize we've requested the wrong file. What to do? In a similar situation using our computer locally, we know we can (usually) abort a command by typing control-break. Is there a similar sequence that we can use in this case?

Suppose there is: Let's assume there's a character we can send that the remote computer will recognize as "break: abort this command." But . . . when do we send it? The remote computer is busy using the line, merrily sending us the wrong file. We can't reply until it's done, because our modem only has one data channel; that is, the remote computer can send data to us, or we can send data to it, but both cannot occur simultaneously. A telecommunications link like this

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that uses only a single channel, which can move data in only one direction at a time, is called *half-duplex*. A special kind of half-duplex channel that can move data in only one direction is called *simplex*. Simplex channels are one-way: We can, for example, use a simplex channel to send data to a computer, but we won't be able to receive data from it (unless of course we have a second independent simplex channel). Our half-duplex situation is not quite that bad; we can use it to send in either direction, but we are limited to sending data in only one direction at a time.

What we need is one modem that combines two simplex channels; with that, we could use one channel to receive data from the remote computer and the other to simultaneously send data to the remote computer. Modems that can put two independent channels onto a single phone line are called *full-duplex*; they allow movement of data in both directions simultaneously.

It would seem a fairly straightforward extension of our encoding scheme might transform our half-duplex modem into a full-duplex job: Simply add two more frequencies. And indeed that would be (almost) the case, if our single channel hadn't hogged so much bandwidth. With a scheme that uses 1000 Hz to represent a 0, and 2000 Hz a 1, there's little room on the high end to allot two more frequencies, and no more on the low end.

So back to the drawing board. Let's pick four frequencies this time, two per channel. But before we do that, a short discussion about an electrical circuit called a filter.

By now you're probably familiar with the basic concept of filters. A water filter, for example, has an input and an output; the filter extracts some of what it finds in the input (dirt) and doesn't pass it to the output. If all we had was water and we needed to fill a gorge, that's not quite the filter we'd want; in those circumstances, we'd want a filter that trapped the water and passed the dirt.

An electrical filter is very similar. It has an input and an output; some portion of what goes in comes out. Electrical filters come in three basic flavors. A low-pass filter lets through all frequencies under a specified amount; a high-pass admits all frequencies above a specified amount, and a band pass (you guessed it) passes the band of frequencies between two specified frequencies—say 1800 and 2400 Hz.

Now, let's think for a second about the modem we are designing. We want to send, or *transmit*, one pair of frequencies from our computer to the remote computer; in our example, that pair of frequencies will encode the break signal we are feverishly trying to send to the computer. Simultaneously, and over the same phone line, we want to *receive* a second set of frequencies, which encode the data file the computer is downloading to us. Now if that ambitious scheme—putting two different frequencies on the phone at the same time—is going to work, we'd better make damn sure that the frequencies we're using to send data don't get confused with the frequencies being used to receive data. That can happen pretty easily: When you talk into a phone, some of the signal is purposely fed back to the earpiece so you can hear what you're saying. That fed-back signal is called *sidetone*, and if you've ever tried to use a phone with no sidetone, you've realized immediately that it was broken. Even without a purposeful generation of sidetone, it's impossible to keep the signal going out totally separated from the one coming in. Thus our modem needs some way to separate out the incoming signal both from the outgoing signal and from any *in-band* noise that happens to be on the phone line.

Which, of course, is why we had that brief discussion of electrical filters a few paragraphs ago. If we pick our pairs of frequencies properly, we can use a filter at each end; the one at our end will let through only those frequencies that the remote computer is using for transmission (our receive frequencies); the one at the remote end will let through only those frequencies we are using to transmit to it.

And what's the best filter to use? To prevent unwanted tones, also called out-of-band noise, from getting through the filter to the decoding circuits, it would seem the best filter is the one that lets through the least. It has to let through our chosen pair of frequencies, of course, but beyond that, the less that comes through, the better. That implies we should use a band-pass filter and make the band just large enough for our two frequencies. And to keep the outgoing frequencies from getting in the way of the incoming frequencies, it might be a good idea to keep the *two pairs* of frequencies as far away from each other as possible.

Now we're getting somewhere. We know we need two pairs of frequencies, spaced as far from each other as possible; we also know that within each of those pairs the two frequencies should be fairly close together. So let's pick a pair—or more correctly, a pair of pairs. How about 1000 and 1200 Hz for one pair and 2000 and 2200 for the other? No, that's too easy to remember. Let's pick 1070 and 1270 for the low-band pair and 2025 and 2225 for the high-band pair.

Will that work? Those just happen to be the pairs of frequencies that all Bell-type 103 modems use. (What an amazing coincidence.) Bell 103 modems are the very popular, full-duplex jobs that can transmit data

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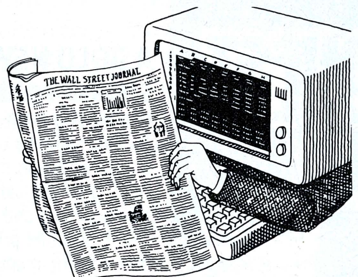

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at, well, it used to be up to 300 bits per second, but it's now sometimes up to 600 bits per second. The Hayes 300 baud Smartmodem (and the 300/1200 baud modem at its lower data rate) and similar low-speed modems are Bell 103-compatible, meaning they use the 1070/1270 and 2025/2225 tone pairs (and adhere to certain other standards, which we'll discuss later).

There is one problem with this setup so far. Remember the nasty trick the phone line played when we didn't transmit data? It had a special AGC circuit that cranked up the volume as far as it could when the line went totally quiet. There is, fortunately, a fairly simple solution to that problem: Just send one of the frequencies all the time. For example, let's say we decide to let 1270 represent a 1. (That's what Bell did, as a matter of fact, and if it's good enough for Bell, it'll do for this column.) Just to confuse the neophytes, we'll send that 1270 tone both when we have a 1 bit to transmit and when we have no data at all to transmit; when it comes time to send a 0, we'll change the 1270 tone to the 1070 tone. In modem parlance, a 1 bit is sometimes called a *mark*, so a scheme like this one, which holds the line to a mark when no data is being sent, is called, sensibly enough, mark hold. While we're tossing synonyms around, in telecommunications a 0 bit is frequently called a *space*. Thus, in our example, 1270 is the mark tone and 1070 the space tone for one channel, and 2225 and 2025 the respective mark and space tones for the other channel.

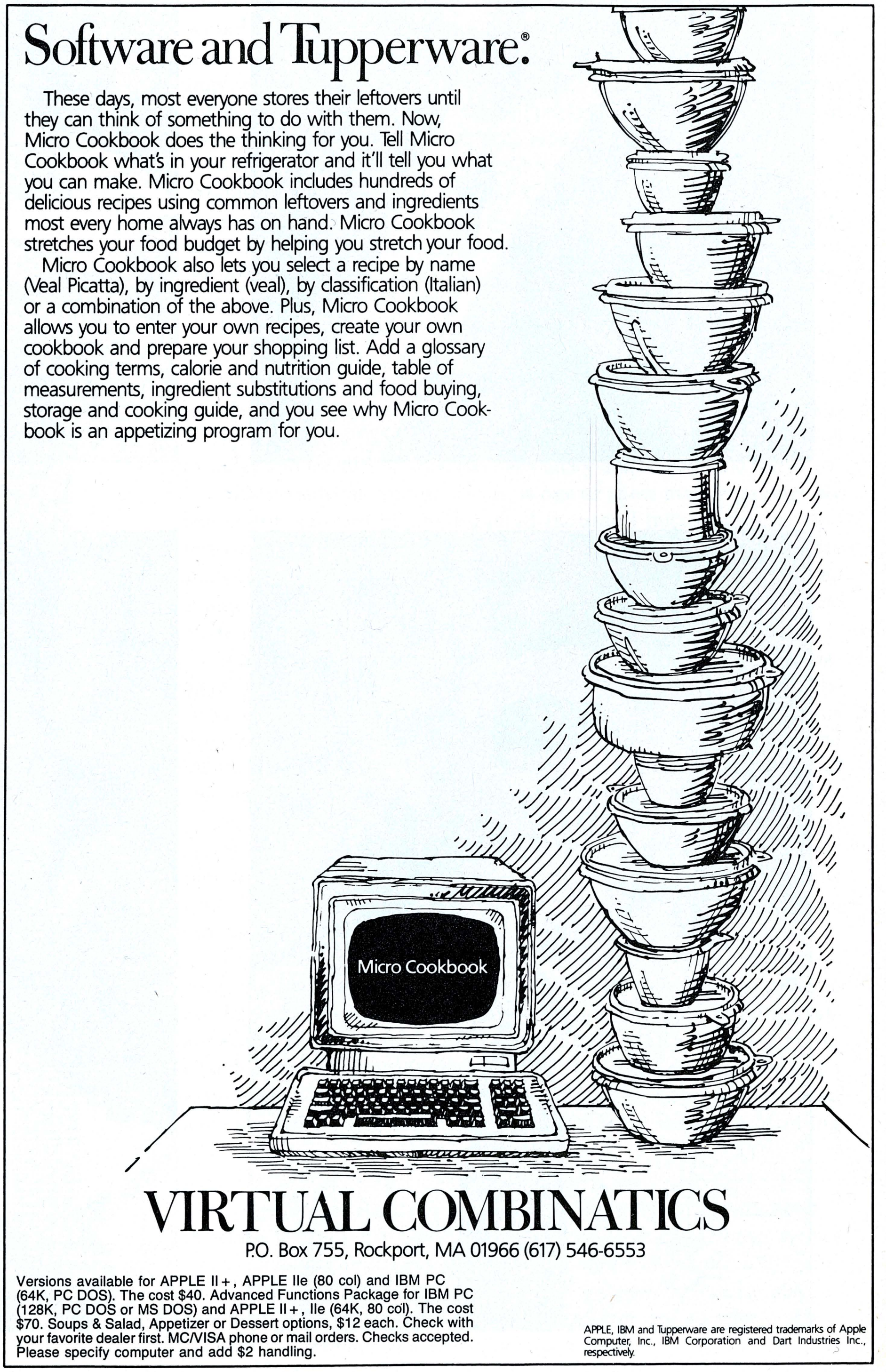
By alternating between two relatively high (at least with respect to the data rate) frequencies, our scheme successfully uses analog tones to carry digital signals. In communications jargon, the 1270 Hz tone that represents both "no data to send" or a 1 bit is called a *carrier*, and it is *modulated*, or switched, to 1070 Hz by the data to be sent: Sending a 0 bit to the modem switches the carrier to 1070. And (hold on, we're almost through with these definitions . . .) since the physical property that's being switched is frequency, such a system is also described as *frequency shift keyed*.

Got it? Don't worry if you don't remember what all these buzzwords mean; the important thing is, when you come across them the next time you won't feel intimidated.

Putting a carrier on the line constantly, rather than turning it on only when there is some data to be sent, has yet another advantage: It makes it quite easy to tell when the connection has been broken. If, once a connection is established, the modem on either end loses (quits hearing) the carrier being transmitted by the other side for more than a given length of time (usually 500 milliseconds—half a second—and frequently settable), it automatically assumes the connection has been broken and hangs up. Modems go through quite a little tone dance when they first make a connection, sort of like a series of electrical mating calls; if carrier is not received within a predefined period of time after the phone is answered, many modems are wired to hang up. There are some other technical advantages to constant carrier schemes, but it is not necessary to go into them here.

By now you may have noticed that although constant carrier buys us several advantages, it also presents us with another problem: It's no longer possible to tell when the remote computer has started sending us data. Under our simple-minded original plan, the line was quiet when no data was being sent; the start of tone meant the start of data transmission. But now, it's possible we could have been receiving a pile of all 1s for the last ten minutes and not even know it. So while we've answered several problems, we've clearly created another.

We'll frame the answer to this newest dilemma in a future installment. ▲



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BPI SYSTEMS

An IBM Original

by David Hunter

When the Apple II first appeared in 1977, Apple cofounder Steve Jobs made an analogy between the automobile and the personal computer. He predicted that the personal computer would be put to many uses as yet unimagined, just as cars have been put to uses that turn-of-the-century automakers couldn't foresee.

Practically every day, Jobs's forecast is proven accurate. Who could have imagined seven years ago that personal computers would be used for controlling the environment of a house, creating music, designing everything from ultralights to solar-heated dwellings, and helping the handicapped? Who could have imagined that the personal computer would play an integral part in the running of tens of thousands of small businesses.

When they first appeared, automobiles were by themselves a promising technology, but without good roads they couldn't have competed with horses or even a physically fit individual. Software is to computers what roads are to cars. The usefulness of the IBM Personal Computer and its ilk depends on smooth, well designed routes that lead to a desired goal.

Paving the Way. IBM has attracted some of the most innovative and expert road builders in the personal computer world. Some of these master paviors work directly for IBM, but by far the majority are independent, strong-spirited individuals or groups that have adopted the IBM Personal Computer as the informational tool of today and tomorrow. IBM has been lucky and so have the rest of us.

BPI Systems of Austin, Texas, is one of these master paviors. By last count, upward of one hundred thousand microcomputer systems are equipped with one or more of BPI's accounting software packages. BPI is a remarkable success story that begins, like so many others, with a small, tight-knit group of entrepreneurs and their recognition that a personal computer needs a good road.

John Moss, chairman of the board at BPI, is semiretired nowadays, not taking part in the day-to-day activities of running the company. An accountant by trade, Moss spent thirty years of his life owning and operating small businesses. It was his energy and business instincts that got BPI started in the late seventies and steered the company onto its continuing course of success.

In 1977, Moss was overseeing a franchise chain of retail food stores in the state of Texas when he realized that an accounting system using microcomputers could improve the operation. At the time, the general accounting for Moss's operation was sent to an outside accounting firm that used mainframes.

The time required to get the information to and from the accounting firm caused some of the smaller stores in Moss's chain to fall behind. They couldn't react fast enough to the changing market scene. Moss, who had seen Radio Shack's TRS-80 Model I, realized that microcomputers could offer the individual accountant a way to manipulate financial data quickly and easily. He envisioned a system similar to but scaled down from what the big accounting firms used.

This page (top to bottom): Jerry Greifer, comptroller and assistant secretary; Ann Oppenlander, BPI's vice president of customer service and documentation. Opposite page (clockwise from upper left): John Moss, cofounder and chairman; Randy Ferguson, cofounder and president; Tom Meadows, senior vice president and secretary; Ken DeBower, cofounder and executive vice president.

Ferguson and Meadows conferring in BPI's Austin offices.

"John is not a programmer," says Randy Ferguson, BPI's president, "but he's a visionary who saw the potential of the microcomputer to help with these aspects of running a small business."

General DeBower. In 1978, Moss met Ken DeBower, a data processing professional with nearly eighteen years' experience. Moss hired DeBower to write a general ledger program for use in his retail food store chain. Working weekends, DeBower wrote the general ledger program on the Apple II and, aside from one major revision, the program has remained the same through the years and is used by tens of thousands of businesses.

Woe to the entrepreneur who misses an opportunity. Moss showed the general ledger program to a computer store dealer in Dallas and struck up a deal wherein he and DeBower would deliver five hundred systems over the course of five months. Moss wrote the user manual for the product, and the program became very popular with those who ran across it in those early days.

At the same time that Moss and DeBower were starting their modest accounting software business, a native Texan named Randy Ferguson was starting a similar scheme.

Ferguson, who was vice president of operations at the Austin National Bank, was trying to find an accounts receivable system for his twin brother's small business. Ferguson had spent five years in the data processing department at the Austin National Bank, working in sales. He also did a small amount of programming on Wang minicomputers.

Early in 1979, Ferguson wrote an accounts receivable program for his brother on the Apple II and was so impressed with the outcome that he decided to start selling it.

As fate would have it, Ferguson and Moss met in a Waco computer store when Ferguson went searching on his brother's behalf for a general ledger program. Ferguson found the program and his future business partners.

In the summer of 1979, Moss, DeBower, and Ferguson each put up a thousand dollars and formed BPI Systems. The company's initials stand for business, professional, and industrial, which are the three main markets the trio decided to go after. The first general ledger programs started shipping in July 1979, and BPI was off and running.

Good News Travels Fast. From the start, the company seemed destined for success. Within half a year of having formed BPI, DeBower and Ferguson quit their regular jobs to devote all their time and energy to the company. Their first two products were well received and, despite the lack of a firm distribution network, the good word about BPI's products spread; it spread all the way to the heights of Mount Olympus.

Both Commodore and Atari were impressed with BPI's accounting software and struck up mass purchase deals in 1980. In those early days, BPI hit upon a good scheme that circumvented the dearth of distributors—sell programs en masse to computer manufacturers and let them handle the distribution. By 1980, small business applications and microcomputers seemed a perfect marriage. The personal computer manufacturers saw a way to sell more machines, and it's remarkable how many came knocking on BPI's door.

By mid 1980, BPI was shipping three to four hundred a month. The company was run entirely by Moss, DeBower, Ferguson, and Moss's wife Margaret. In November of that year, the company hired its first salaried employee.

One of the biggest milestones in the company's history came when Apple Computer inquired about distributing BPI's accounting software for the Apple II. A deal was struck in short order and BPI started shipping thousands of products a month.

The story of how BPI came to an agreement with IBM to provide five accounting packages for the IBM Personal Computer makes for a good folk tale to tell around the corporate campfire.

IBM first contacted BPI in February 1981 and said it was interested in reviewing the company's product line. Big Blue's representatives didn't say why, and would not accept copies of BPI's accounting products without paying for them. They also made BPI sign a nondisclosure agreement, which for three years kept the software company from acknowledging that the meeting had taken place.

A Little Secret. Through innuendoes dropped during the meeting and a little imagination, Moss, Ferguson, and DeBower gathered that IBM was about to enter the microcomputer market. Ferguson says that between the months of March and May the two companies went through a "kind of mating dance."

"In May, IBM asked for a complete proposal," says Ferguson, "but we didn't know enough about the machine. We didn't know what the language would be. We found out it might be Basic, but not necessarily CP/M. We did know it would be *like* CP/M."

IBM drew up a proposal that had a delivery date that Ferguson says BPI found "impossible to meet."

During these early negotiations, IBM had been sending paperwork and various memos to BPI, insisting that the company keep them in a locked filing cabinet in a special safe. Remember, this was still several months before IBM officially announced the Personal Computer. The need for secrecy notwithstanding, the folks at BPI got a little nervous.

"IBM would not move from its proposed delivery date, and we had no choice either," says Ferguson. "We bundled all the information in the safe together and sent it back to Boca Raton by Federal Express. It was no use kidding each other.

"The next morning IBM called back very surprised, but they still really wanted BPI's program for their new machine. They came to Austin the following Monday with attorneys and contract negotiators. We worked two days on that contract, and it's been a great agreement ever since."

In June 1981, IBM sent BPI four pcs and a security guard. "They bought five first-class seats on a plane," says Ferguson. "The guard couldn't let the boxes leave his sight."

Tile Tales. There were even more security measures needed when the machines got to BPI (ceiling tiles were taped down by the security guard so that no one in an adjoining office could break into the special space allotted for the pcs). Other than these elaborate precautions, Ferguson said that the agreement with IBM worked well. Any time information was needed or a problem was encountered, IBM would be on the phone to answer questions or they would send someone up to Austin on the next plane.

BPI agreed to provide five products to be marketed and distributed by IBM. The five are *General Accounting*, *Accounts Receivable*, *Payroll*, *Inventory Control*, and *Job Cost*. Ken DeBower headed up the development team to convert BPI's programs to the pc. DeBower describes the IBM pc as "a real dream to work on."

BPI's products hit the dealers' shelves in March 1982. Six months later, BPI had captured fifty percent of the market; it maintains a comparable market share to this day.

The mutually beneficial relationship between IBM and BPI relies on the particular strengths of the two companies. BPI produces the products, including packaging and documentation, and provides support, while IBM markets and distributes them. It's a relationship that both companies have been pleased with and hope will continue for some time.

BPI and IBM are of like mind. Recent estimates put the penetration of microcomputers into the potential small business market at five percent. And the size of the small business market is enormous. Ferguson calls it "the Fortune fourteen million." Any serious attempt to capture a large part of that market cannot be a half effort. Joining forces gives both parties a fighting chance and is often the most efficient use of available resources.

The OEM Connection. Until this year, BPI has operated for the most part like an OEM (original equipment manufacturer) supplier, shipping its prepacked accounting software to computer manufacturers, who then market and distribute it. The level of expertise—in documentation, support, packaging, and programming—demanded of BPI is no less than that demanded of a more maverick operation, which must attract distributors and dealers by the quality of the product and not by the fact that an IBM or Apple Computer has put its name on it.

Many factors go into making a successful software publishing firm like BPI. One vital ingredient is skilled, creative people. Once the business began to take off, BPI was fortunate enough to attract a number of talented individuals.

Ann Oppenlander, BPI's vice president of customer support and documentation, joined the company in January 1981. Oppenlander, who has a Ph.D. in English, brought to the firm considerable experience in documentation writing. Prior to joining BPI she'd worked at NCR, programming business applications on DEC mainframes, and had spent two years as manager of Texas Instruments's publications department.

When she saw BPI's products, Oppenlander was impressed and accepted Moss's offer to join the young company. She started on the telephone, answering the customer support calls and learning the "audience," which she says was quite different from what she was used to at TI.

"At Texas Instruments, we were writing manuals for programmers. Here was a challenge to make them understandable to everyday people."

Both Ferguson and Oppenlander are convinced that a clear, concise, understandable manual is a critical aspect of putting out a successful software product for the personal computer market. "In this industry," says Ferguson, "it's a case of data processing products being produced by data processing people for non-data-processing users."

By having the dual responsibility of producing the manuals and overseeing the customer service area, Oppenlander knows how

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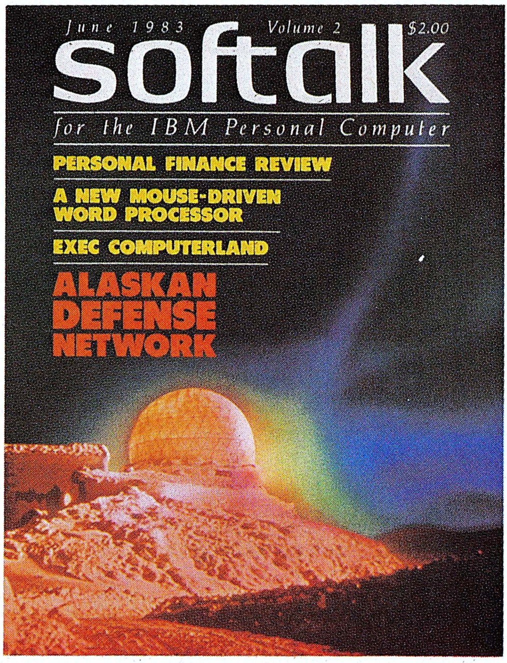

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users are responding to BPI's products on a daily basis. The company regularly receives between five thousand and six thousand calls a month, and a careful tally is kept of the nature of the calls.

Master of Operations. BPI's vice president of operations, Larry Pickel, joined the company early in 1981. He spent nine years with the Austin National Bank in a number of diverse positions, including operations and data processing. For a while, he worked with Ferguson at the bank, and that previous association helped land him the job at BPI.

Pickel refers to his basic responsibilities as making sure "the ox gets out of the ditch." He oversees the product management and administration of BPI. He has two adept managers working under him, one in charge of production and one in charge of administration.

Pickel, like so many others in the microcomputer software industry, left a good, solid job for the uncertainty (and excitement) of software publishing—and is glad he did.

"Where I'm going I can't tell you," he says. "But it took something to make me leave an officer's chair at the bank to come here. All of us, Ken, Randy, Ann, are not just here to make a quick profit. We're here for the long haul."

Gerald I. Greifer is BPI's comptroller and assistant secretary. A cpa by profession, Greifer comes from the world of New York City high finance, where he was with Peat, Marwick, and Mitchell, one of the largest accounting firms in the world.

In the spring of 1981, Greifer helped Moss and Ferguson on BPI's *Payroll* package update as a private consultant. With his knowledge and experience, Greifer has been invaluable to the development of BPI's products. He joined BPI fulltime in November 1981.

Greifer believes that BPI's potential for growth is "unlimited, if we do the right things. This is a small company by New York standards, but it's not disorganized. They say that large companies have meetings too often and that small companies don't meet often enough. Large companies can get very political in their structure. BPI is the perfect world for me."

Accounting Triumvirate. With Moss not in the office on a day-to-day basis, the three top execs that hold the reins at BPI are Ferguson, DeBower, and Thomas Meadows.

DeBower attended the University of Nebraska and discovered computers in the early sixties. He's worked as a programmer at Texas Instruments and Radian Corporation, an environmental and energy consulting firm. The only bonus he ever got at Radian he spent in one afternoon on an Apple II. He saw the personal computer as his ticket to greater things.

As BPI's executive vice president, DeBower spends a lot of time helping to move BPI's programs over to other microcomputers. He sees computer hardware getting smaller and faster in the future. "Computers are still almost a toy, kind of backward. The microcomputer industry is heading toward machines with minicomputerlike performance and capabilities for multiple users."

BPI's senior vice president and secretary, Thomas Meadows, came from IBM, where he held various marketing and management positions. After leaving Big Blue, he had his own consulting firm. A little over a year ago, he came to BPI.

Meadows is a confident and likable marketer who spends a lot of his time on the road, spreading the word about BPI's products. His job is of paramount importance, because the basic strategy at BPI is changing.

Last year, BPI was totally an OEM supplier, but this year the company is trying something new. Ferguson says the company is moving into selected vertical markets on its own and that this type of marketing will account for 40 percent of the company's products in 1983.

Streets of Financial Fire. In June 1982, BPI made a public stock offering, and a little over a month ago the company had its first annual stockholders' meeting. For the fiscal year ending March 31, 1983, BPI reported total revenues of a little more than $6 million and net earnings of $1.5 million. Three years earlier, those figures were seventy thousand and twenty-five hundred dollars respectively.

The company has grown in three years from a half dozen or so employees to around one hundred twenty. BPI occupies several buildings within a mile of each other off Guadalupe, Austin's main drag, just up the street from the University of Texas. BPI has purchased land and is constructing its own building, which the company hopes to occupy by the end of 1984.

Austin, as it turns out, is a good location for a high-tech company. The University of Texas regularly turns out a large crop of bright and eager graduates in computer science and engineering. There are also several large computer firms in the area, such as Texas Instruments and Intel. Most recently, MCC (Microelectronics and Computer Technology Corporation), a research corporation founded by a consortium of American computer firms, moved into the area.

BPI serves nine main clients as an OEM supplier. The nine are Apple, Atari, Commodore, DEC, Hewlett-Packard, IBM, NEC, Sanyo, and Texas Instruments.

"We view ourselves as an extension of the hardware manufacturer's organization," says Meadows. "Each of the nine is different. Yet we have the ability to adapt and do things their way."

With new directions, a solid working relationship with most of the big name microcomputer manufacturers, and a competent, professional staff, BPI is a vital force in the world of financial software. Ferguson believes the company has managed to bring together three professions—journalism, accounting, and programming—into an effective triumvirate. ▲

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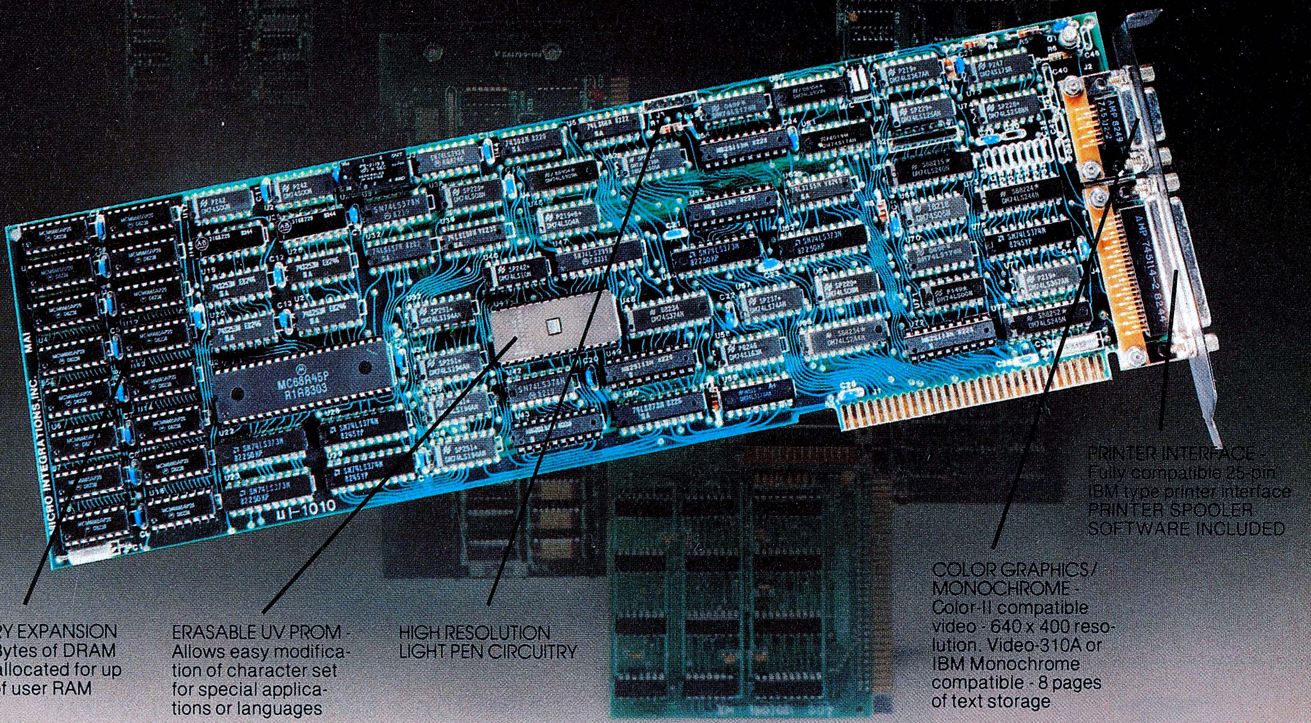

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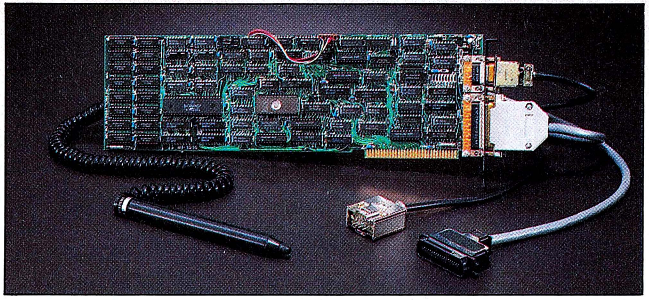

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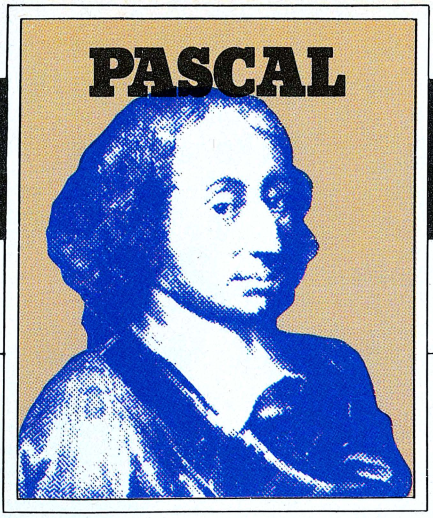

FROM BEGIN TO END

by Bruce Webster and Deirdre Wendt

The Answer Is Files

If you've been following this column for the last several months, you've no doubt noticed the heavy emphasis Pascal places on data structures: scalar variables, enumerated data types (EDTs), records, arrays, sets, and the like. It is no coincidence that when Niklaus Wirth, the father of Pascal, wrote a book on software development, he entitled it *Algorithms + Data Structures = Programs*. A wide variety of these data structures have been used in the examples that have accompanied these columns in order to show just how powerful they can be.

But, as always, a new problem has cropped up. Sure, we can define packed records with variant tag fields or create arrays of sets of EDTs. But what happens when the program ends, as it sooner or later must? All of our nifty data structures quietly vanish and the information they hold is lost. Of course, we often don't care; when the program is done, we're done, too, and no longer need the information. There are times, however, when it would be nice to save that data for the next run of the program. For example, while playing a game, we may want to (or have to) stop for a while (hours, days, weeks). Wouldn't it be a shame to have to start all over again? Especially if we're close to winning? Hmmm?

The Answer Is Files. There is, of course, a solution to this dilemma. (If there weren't, the column would have to end here, and our editors wouldn't be very happy.) The answer: files. ''What is a file?'' you may ask. A file is a collection of data structures, all of the same type. It is somewhat similar to an array, but not really. If that doesn't tell you much, don't worry; the examples should clarify matters.

Let's define the following:

```
CONST
  shipmax          = 40;
TYPE
  ships =
    RECORD
      energy          : 0..1023;
      qx,qy,sx,sy     : 1..8;
      shields,beams   : 0..255
    END;
VAR
  sfile      : FILE OF ships;
  ship       : ARRAY[1..shipmax] OF ships;
  shipcnt    : 0..shipmax;
```

The array *ship* is a collection of 40 records of type *ships*. All of those records are always in memory, and any one of them can be referred to using the notation *ship[indx]*, where *indx* is an integer variable or expression resolving to a value from 1 to 40 (*shipmax*). All the information in *ship* is lost when the program is done.

The file *sfile* manages a collection of some number of records of type *ships*. All of those records are kept on mass storage (floppy disk, hard disk, mag tape). Only one of those records (actually, a copy of one) is kept in memory at any one time. *sfile* points to that record; that is, we reference that record using *sfile*^ (remember pointers from last month?). We call the memory to which *sfile* points the *file buffer*. The file buffer can get a record from disk, or it can put the record it currently holds out onto disk. All the information on the disk remains there, even when the program is done.

By way of example, let's suppose that we've been playing our game for a while and want to quit, but we want to be able to resume the game later. Among other things, we need to save on the disk the information in *ship*. The variable *shipcnt* indicates how many of the

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records in *ship* are actually being used. Those records could be written to disk as follows:

```
rewrite(sfile);              (*open the file for writing*)
FOR indx := 1 TO shipcnt DO BEGIN
   sfile^:= ship[indx];      (*copy record to buffer*)
   put(sfile)                (*write buffer to disk*)
END;
close(sfile);                (*close and save the file*)
```

(N.B. For UCSD Pascal, we would use *rewrite(sfile, 'SHIP.DATA')* to open the file and assign it a name. To close it, we must write *close(sfile,lock)* in order to save the file; otherwise, the file is deleted. For IBM Pascal, give the file a name by calling *assign(sfile, 'SHIP.DATA')* before the *rewrite* statement. The same conventions hold true in both Pascals for *reset.*)

The ship information has now been saved to disk and we've stopped playing. After a while, we want to take up the game where we left off. Among other things, we need to read the records that were saved back into *ship*. One problem comes up, though: How does the program know how many records are in the file? Answer: It doesn't need to. Instead, Pascal provides the Boolean function *eof* (*<file variable>*). *eof* stands for *end of file.* When reading the file, *eof* returns a *false* value until it hits the end; then it returns *true*. The records can now be read in as follows:

```
reset (sfile);                  (*open the file for reading*)
shipcnt := 0;                   (*# of ships in array      *)
WHILE NOT eof(sfile) DO BEGIN
  shipcnt := shipcnt + 1;       (*yes, there is another ship*)
  ship[shipcnt] := sfile∧;      (*copy record from buffer  *)
  get (sfile)                   (*get next record          *)
END;
close(sfile);                   (*close file               *)
```

Put, Get, and Reset. Those of you with sharp eyes will have noticed a few things. First, the *reset* command not only opens the file, but it also reads the first record into *sfile∧*. Second, *put* and *get* are mirror images of each other. *put* writes a record out, then moves to the next slot; *get* moves to the next slot, then reads in a record. Make sure you understand these points well; otherwise, you could inadvertently lose a record by skipping over it.

In our example, *sfile* was a file of records. We can define a file of anything (except files), so this could have been done instead:

```
CONST
  shipmax          = 40;
TYPE
  ship =
    RECORD
      energy : 0..1023; qx,qy,sx,sy : 1..8; beams,shields : 0..255
    END;
  shiparray        = ARRAY[1..shipmax] OF ships;
VAR
  ship : shiparray; sfile : FILE OF shiparray; shipcnt : 0..shipmax;
```

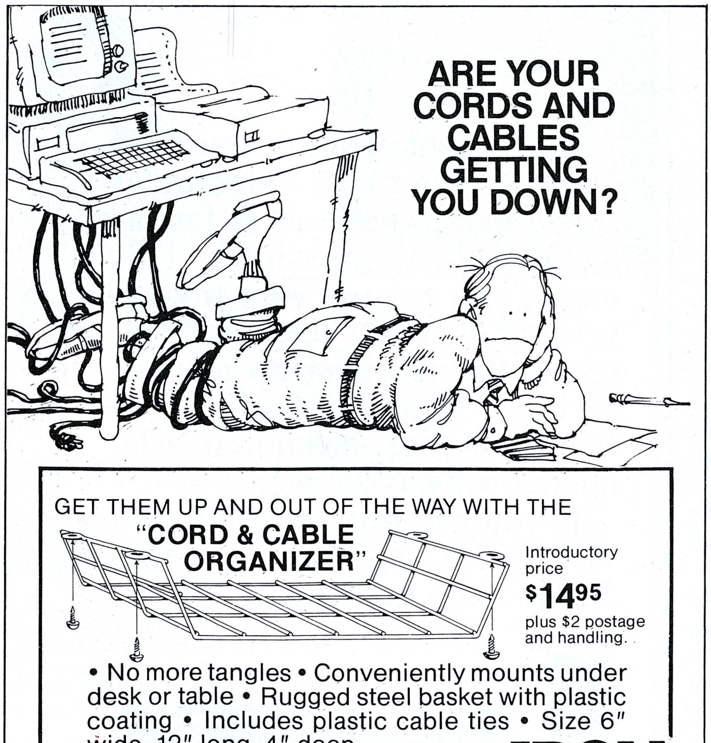
Now, to save the information in *ship*, we could write:

```
rewrite(sfile); sfile∧ := ship; put (sfile); close(sfile);
```

And to read it back in, we write:

```
reset(sfile); ship := sfile∧; close(sfile);
```

Unfortunately, we've now lost track of one piece of information, namely the value of *shipcnt*. However, there are a number of ways around this. First, we could redefine *shiparray* to be a record with two fields: the shipcount and the array itself. Second, we could save the value of *shipcnt* in another file, either by itself or as part of another data structure. Third, we could assume that any ship with an energy level of 0 doesn't exist; then, after we read *ship* in, we'd just go through and count all of the records with nonzero energy levels. Finally, we could rewrite the game so that the value *shipcnt* was no longer needed.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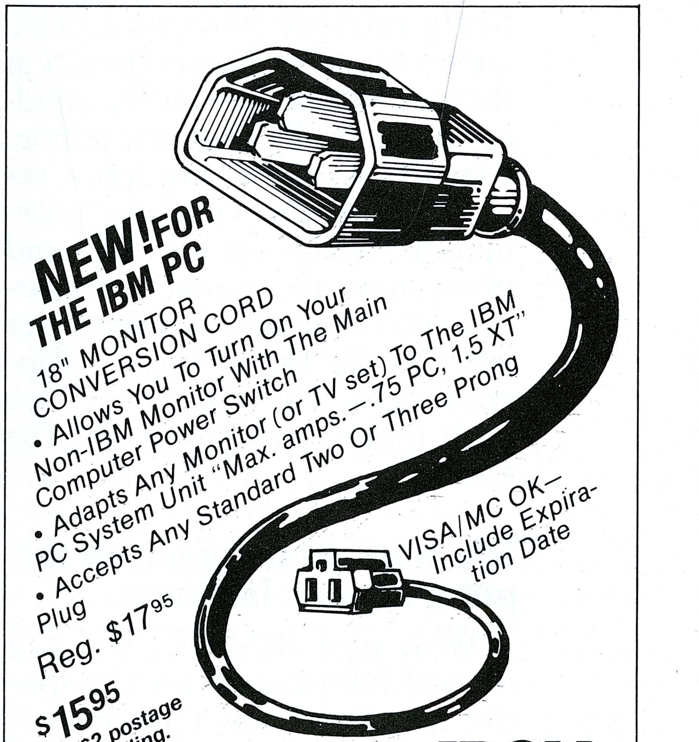
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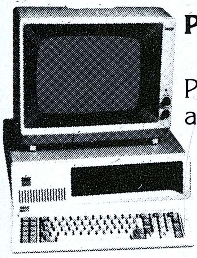

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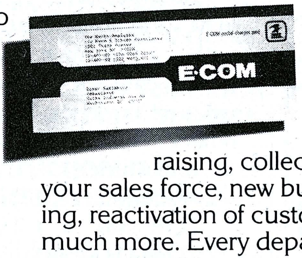

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The Pizza Program is a complete menu planning system you customize to fit your tastes and budget. It's not a recipe file but rather a practical way to organize your meal planning. You'll appreciate it day after day, week after week. People across the country are finding it a super idea—a great companion to any kitchen.

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You can try it with no obligation. Our home trial lets you actually use The Pizza Program for a full 15 days before you decide to keep it. Watch the fun and convenience it creates. Enjoy better meals and see how much time it saves. If you are not satisfied for any reason, return it within 15 days and owe nothing. If you approve, you'll be billed later for just $34.50 plus $2 for shipping and handling. (California residents add 6½% sales tax). A full 40 pages of instructions are included.

OUT OF THE RUT

One woman's reaction to this program is typical. She wrote, "Before using your system I found myself getting into a rut of serving the same things over and over. The Pizza Program has changed all of this for me. We now have a wider variety of dinners and best of all I don't have to decide what they will be. If this was all it did, I'd be thrilled. But it isn't. The shopping list I receive along with my menus has been such a time-saver. I quickly run through it and delete anything I feel I don't need and add something I might. I would have a hard time going back to doing my menus by hand."

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Textfiles. Pascal differs from Basic, Fortran, and several other languages in that it writes data files as *binary* files rather than *text*files. In other words, Pascal stores a two-byte integer value as a two-byte integer value, not as a character string several bytes long, with spaces and carriage returns as delimiters. This results in smaller data files and faster disk I/O (since there is no conversion from data to ASCII and back). This also allows us to do things like read in or write out an entire array with a single command, rather than having to use intricate loops and heavily formatted I/O statements.

Often, though, we *do* need to read and write textfiles—for example, when we are reading in user-entered data or writing out reports or other information. Pascal allows for that, too. We can use the predefined data type *text*, which is equivalent to *FILE OF char*. So, for example, we could define:

```
PROGRAM filetest;
VAR
  infile,outfile   : text;
BEGIN
  reset(infile);
  rewrite(outfile);


END. (* of PROGRAM filetest *)
```

We can now read in text from *infile* and write it out to *outfile*. Realistically, though, it could get really boring having to read and write text a character at a time (using *get* and *put*). So Pascal has provided some more powerful routines for reading from and writing to textfiles. They are:

read(f,p1,p2,...,pn)	reads in the variables **p1** through **pn** from textfile **f**
readln(f,p1,...,pn)	reads as above, plus advances to next line
write(f,p1,...,pn)	writes variables **p1** through **pn** into textfile **f**, all on same line
writeln(f,p1,..,pn)	writes as above and advances to next line
eoln(f)	Boolean function—returns *true* when at end of line in textfile **f**.

These routines are pretty much what they appear to be. In most micro implementations of Pascal, the parameters are limited to integers, reals, characters, and some form of string. Let's say that we wanted to write out the data for our game in textfile format and had *infile* and *outfile* declared as *text*. Our game save routine might look like this:

```
rewrite(outfile);
writeln(outfile,shipcnt);
FOR indx := 1 TO shipcnt DO
  WITH ship[indx] DO BEGIN
    write(outfile,energy:6,qx:4,qy:4,sx:4,sy:4);
    writeln(outfile,beams:4,shields:4)
  END;
close(outfile);
```

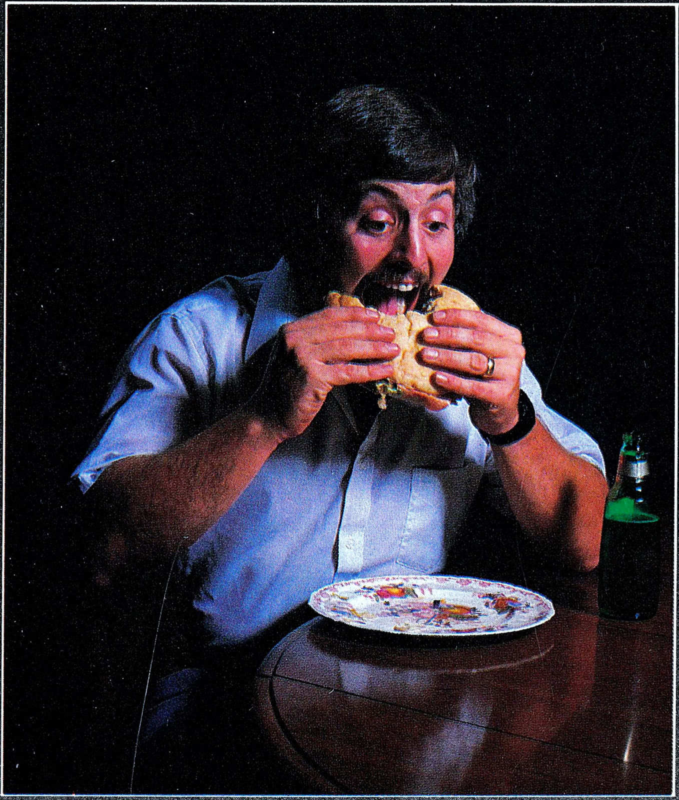
(The formatting notation, *p:n*, means to right-justify the value of *p* within a field of *n* characters. More on this next month.)

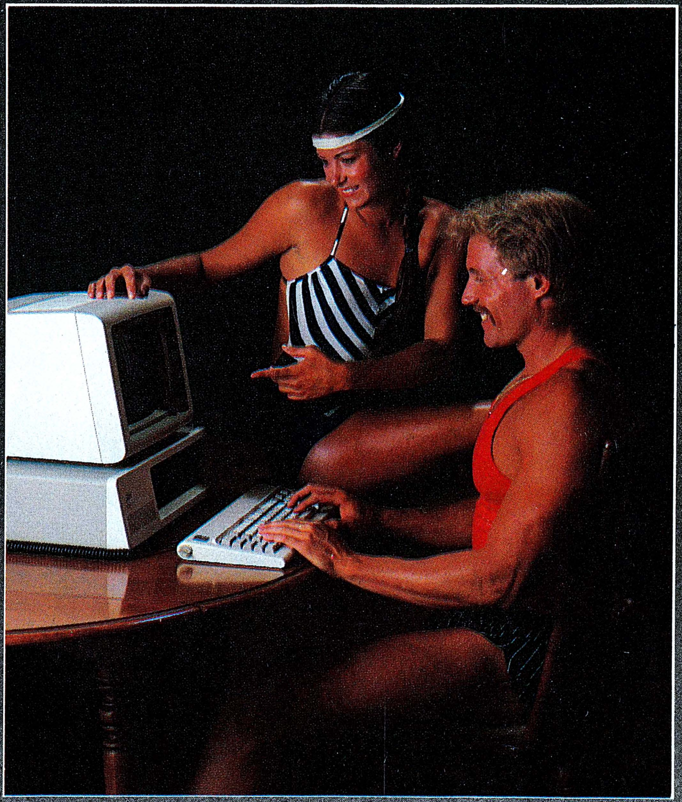
We could, if we wanted, print out our ship data file and see just what all those values are (something we couldn't easily do with a binary file). To read the data back in, write:

```
reset(infile);
readln(outfile,shipcnt);
FOR indx := 1 TO shipcnt DO
  WITH ship[indx] DO
    readln(infile,energy,qx,qy,sx,sy,beams,shields)
close(infile);
```

There are a lot more details to discuss, especially about textfiles, but we've given you enough for now. Next month, we'll talk more about formatting, the *eoln* function, interactive files, random access files, and more. ▲

Help Yourself





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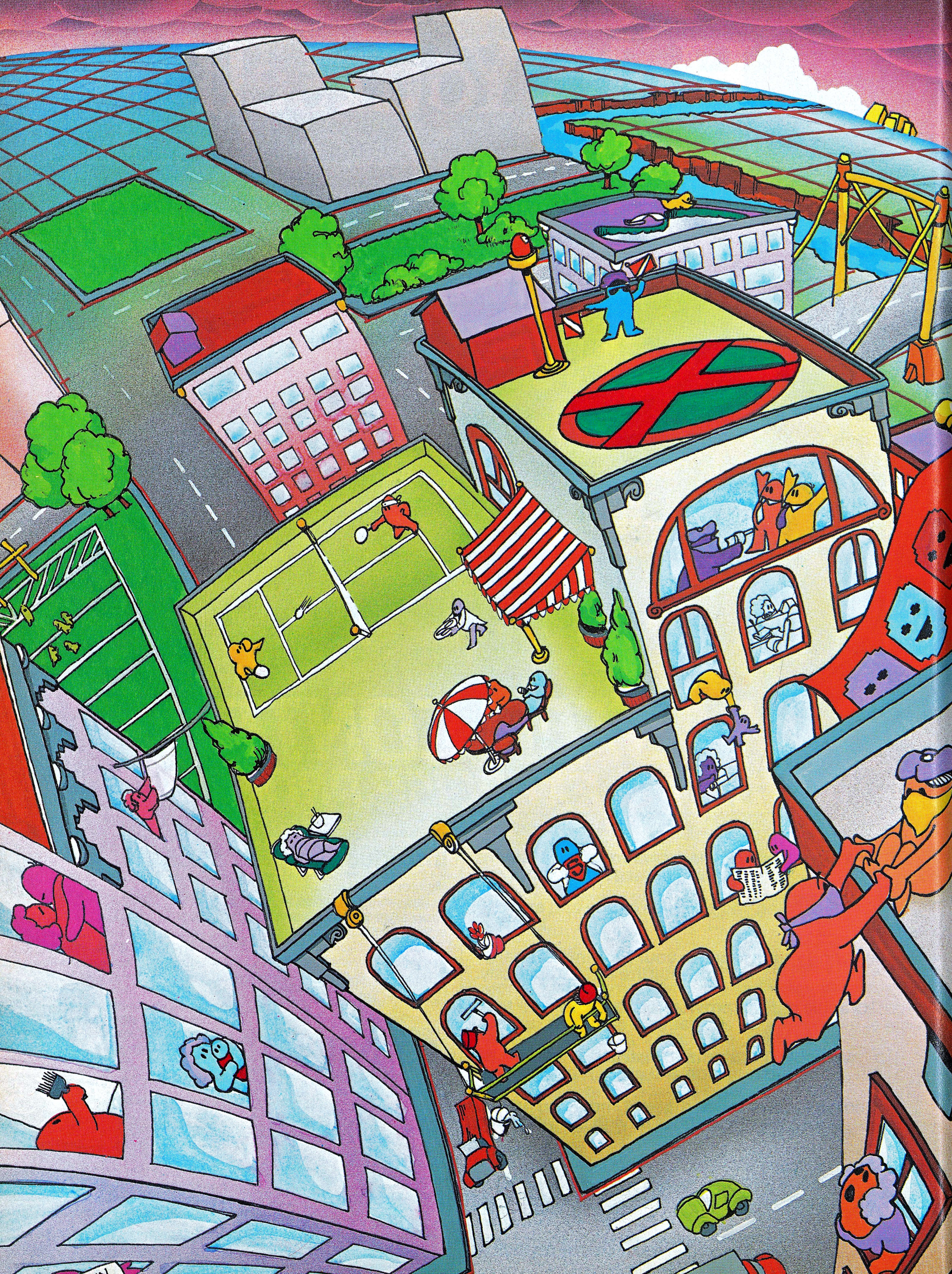
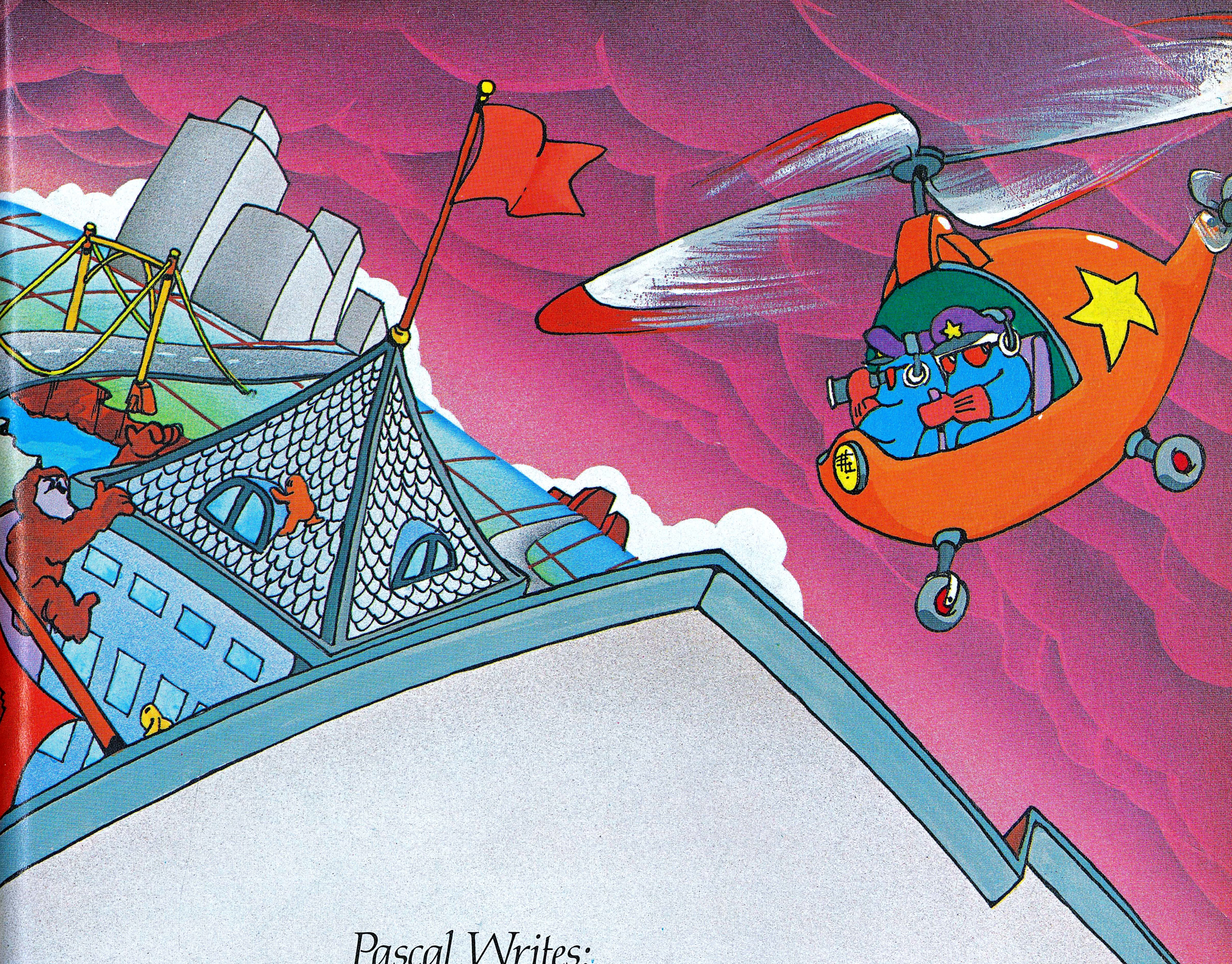




Pascal Writes:

THE GAME OF LIFE

Life . . . was invented in 1970 by Cambridge mathematician John Horton Conway. It is played on a checkerboard grid that extends indefinitely in all directions. Each cell on the grid can be considered empty or full ('dead' or 'alive'), depending on what occupies the eight surrounding cells, and on the following laws:

"1. The Law of Survival. *A cell with two or three neighbors will survive for the next generation.*

"2. The Law of Death. *A cell with more than three neighbors will die of overcrowding. A cell with fewer than two neighbors will die of isolation.*

"3. The Law of Birth. *An empty cell with exactly three neighbors will be filled in the next generation.*

"The three laws operate simultaneously, and every generation of Life may produce a new pattern. Depending on its shape, a pattern may be static or changing. It may move about the board. Some patterns can give birth to new ones. Others can devour intruding cells. Some surprisingly simple patterns metamorphose through thousands of generations in a bewildering series of shapes."

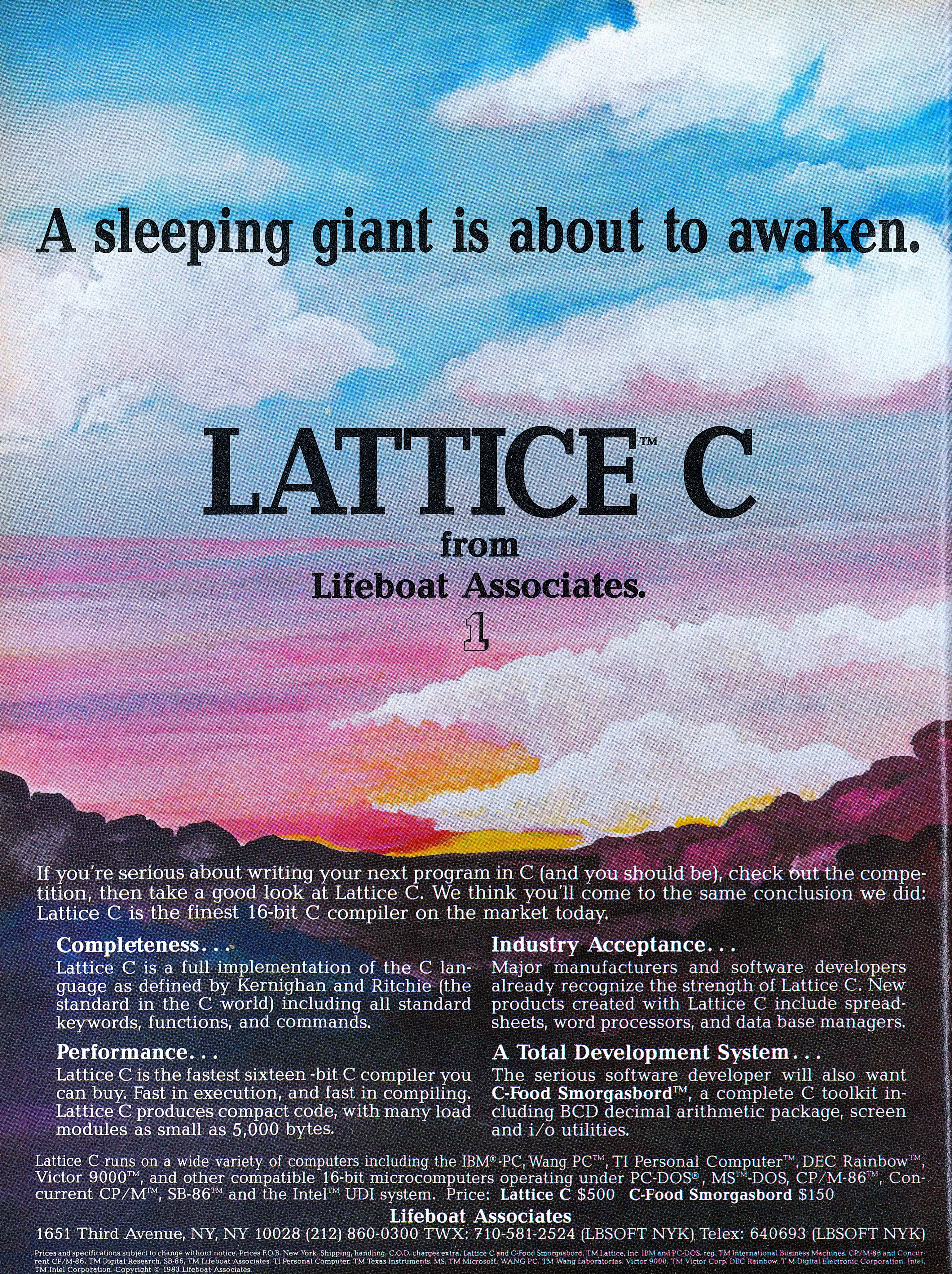
-Softalk, *December 1982*

As this excerpt from a previous issue points out, *Life* is not your typical computer game. It is a study of the behavior of a population subject to three simple rules. The rules completely determine the growth of the population.

The game of *Life* is appealing because it's simple enough to be learned in a minute yet complex enough to have infinite variety. It

by Robert Fruit

Art by Tennesen/Tobin Studios



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can hold the interest of a child or tease an accomplished mathematician.

The fact that a group of scholars at MIT would create a *Life* situation with thirteen glider guns positioned so that a fourteenth will be created from collisions of the first thirteen (see the aforementioned article) shows what extremes people will go to in exploring *Life*'s properties. It also shows what fascination a game with simple rules can have.

The following program allows you to check out *Life* for yourself. It was written in IBM Pascal for the sake of execution speed; interpretive Basic turned out to be too ponderous.

For those of you who do not want to key in the program or who don't have a Pascal compiler, a disk with the program is available. The disk has the program shown in this article in its source code form, as well as two execution files, called Life.exe and Lifegrph.exe. The first is the program for the monochrome display, and the second is the same for the graphics adapter. A short documentation file will also be found on the disk. To receive the disk, send your name and address and $8 to Softalk Life, Box 60, North Hollywood, CA 91603. Please allow a few weeks for processing.

Operating the Game. The working area for this version of *Life* is 50 cells wide by 235 cells high. The area is centered on the eighty-column display. The 50-by-50 cell arrangement seems a reasonable compromise between the physical limitations of the display screen and the ideal working area, which would extend to infinity in every direction.

When the program is started, the screen is blank and the cursor is in the middle of the screen. The number keys, keys 0 through 9, are the only operational keys on the whole computer. Even the break key will not work. The Pascal program intercepts every key as it's pressed and only lets those keys for which it has instructions through for processing. The program is in its setup mode.

The program is waiting for the initial conditions for the *Life* game to be set before it will start to process them. Using the numeric keypad, with the numlock toggle set for numbers, is the easiest way to set up the initial conditions. The keys 1 through 8 are direction control keys, as follows:

7 8 9
4 6
1 2 3

The top, bottom, and left and right sides of the working area are set so that, should the cursor be moved out of bounds, it will wrap around to the other side.

When you want to enter an organism in a cell, hit the 5 key. If you want to remove an organism, move the cursor to the appropriate cell and hit the 5 key (the key is a toggle; it removes an organism if there's one there or implants one if there's not). When a life is created, a happy face, ASCII character 1, is placed on the screen. When a life is destroyed, the happy face is removed.

This method of setup allows you to review the initial conditions as you create them. When you're satisfied with the conditions you've created, hit the 0 key. That will start the program to grow the patterns according to *Life*'s rules. On the top left of the screen, you'll find a counter showing how many generations have been processed.

Other than watching the screen change as *Life* unfolds, the only thing you can do is stop the program with the break command (the break command will operate with the program in the generation mode) or suspend the game temporarily by hitting escape.

Pushing the escape key causes the program to reenter its setup mode without changing the current status of the display. All the setup commands will operate to make any changes you desire, and the 0 key will return the program to generation mode with the display in its new status. Of course, you can also use the escape key to halt execution temporarily so that you can leave the computer for a while without missing any of the action.

The program will run forever, if it's not interrupted by something outside itself. The best way to stop the program (without turning the computer off) is to exercise the break command while in generation mode.

The Program. The program was written to work with the IBM pc and the monochrome display. To make it run on the graphics board instead, you need change only one line. In the procedure CLRSCRN, the first statement is "Screen.S := 16#B000;". Change this statement to read "Screen.S := 16#B800;" and you'll be up and running in graphics.

The program was written so that each module does just one thing. This makes it easier to understand and debug each module as it's developed. Here are the modules:

Procedure LOCATE places the cursor at a specific location on the screen.

Procedure CLRSCRN clears the display.

Function CHECK_KEY checks for the escape command.

Function INKEY intercepts the keyboard until a key is pressed.

Procedure ZERO sets all initial conditions.

Procedure XPOS moves the cursor horizontally one cell.

Procedure YPOS moves the cursor vertically one cell.

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Procedure TOGGLE toggles a happy face on or off.

Procedure SET_UP reads the keyboard and responds to the 0 through 9 keys.

Function LIVE determines if the next generation of a cell will have a life.

Procedure CHECK determines the status of every cell for one generation.

There are only a few modules that make this program specific for the IBM pc. They are LOCATE, CLRSCRN, CHECK_KEY, and INKEY. Any computer that has similar Pascal routines could use those routines in place of the ones used here.

There is room for some improvement in this version of *Life*. First, the screen area could be extended off-screen to allow the life patterns to grow full in the display area without the distortion the current boundaries create. That would require commands for placing lives in those off-screen areas. If five extra spaces were added to every boundary, then the generation speed would be reduced from sixteen per minute to ten per minute. Not too bad for the improved viewing that would create.

Having ten extra spaces would probably prevent the boundary from noticeably distorting the display, even when several hundred generations are studied. However, that would slow the generations down to six per minute, which seems a high price for the improvement afforded.

The LIVE function uses the direct method for determining the number of surrounding lives, summing the values in the eight surrounding cells. The sum is then used to determine whether or not a life will be in the next generation. There are probably less arithmetic-intensive methods that could run faster.

Life. Some basic shapes prove how interesting *Life* can be. The first one to try is a horizontal line. Just fill in the working area with a horizontal line starting at the cursor starting position and continuing until the cursor position is reached from the other side.

Filling the working area with a giant X gives another simple, interesting design.

Of course, the shapes discovered by the early explorers of *Life* are still of interest. Two of the more intriguing ones are the glider:

```
 #
  #
###
```

and the R-pentomino:

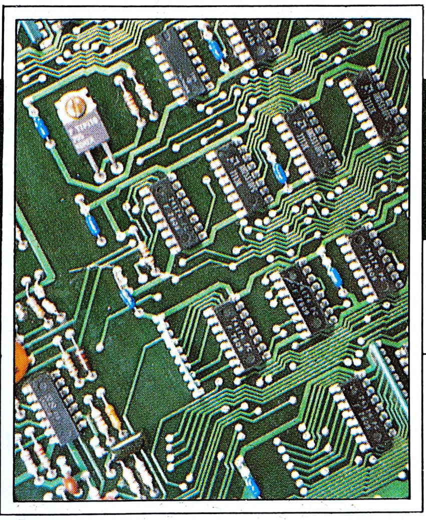
```
 ##
##
 #
```

Have fun discovering the world of *Life*.

The Game of Life in IBM Pascal

```
A>type life.pas
 ($TITLE:'GAME OF LIFE')
 ($INDEXCK-)
 ($MATHCK-)
 ($NILCK-)
 ($RANGECK-)
 ($STACKCK-)
 PROGRAM LIFE (INPUT,OUTPUT);
 LABEL
  AGAIN;
 VAR
  POS : ARRAY [0..51,0..26,1..2] OF 0..1;
  W,Z : 1..2;
  X : 0..51;
  Y : 0..26;
  KEYBOARD : FILE OF CHAR;
  ROUND : INTEGER;
 PROCEDURE LOCATE (X,Y:INTEGER);
 TYPE
  CURSOR_DATA = RECORD
   POSX,POSY : CHAR;
   END;
 VAR
  CURSOR [STATIC] : ADS OF
  CURSOR_DATA;
 VALUE
  CURSOR.S := 16#40;
  CURSOR.R := 16#50;
 BEGIN
  CURSOR^.POSX := CHR(X);
  CURSOR^.POSY := CHR(Y-1);
  WRITE(CHR(8));
 END;
 PROCEDURE CLRSCRN;
 CONST
  BLANK = '   ';
  NOR_ATT = CHR(7);
  CRT_SIZE = 4096;
 TYPE
  CRT_BUF = ARRAY [0..CRT_SIZE]
  OF CHAR;
 VAR
  SCREEN :ADS OF CRT_BUF;
 BEGIN
  SCREEN.S := 16#B000;
  SCREEN.R := 16#0;
  SCREEN^[0] := BLANK;
  SCREEN^[1] := NOR_ATT;
  MOVESL(SCREEN,ADS
  SCREEN^[2],CRT_SIZE);
  LOCATE(1,1);
 END;
 FUNCTION CHECK_KEY:BOOLEAN;
 BEGIN
  GET(KEYBOARD);
  IF KEYBOARD^ <>CHR(27) THEN
   CHECK_KEY := FALSE
  ELSE
  CHECK_KEY := TRUE;
END;
FUNCTION INKEY:CHAR;
BEGIN
 REPEAT
  GET(KEYBOARD);
 UNTIL KEYBOARD^ <>CHR(0);
 INKEY := KEYBOARD^;
END;
PROCEDURE ZERO;
BEGIN
 FOR X := 0 TO 51 DO
  FOR Y := 0 TO 26 DO
   FOR Z := 1 TO 2 DO
    POS[X,Y,Z] := 0;
 X := 25;
 Y := 12;
 LOCATE(X+15,Y);
 WRITE(' ');
 LOCATE(X+15,Y);
END;
PROCEDURE XPOS (D:BOOLEAN);
BEGIN
 IF D = TRUE THEN
  X := X + 1
 ELSE
  X := X - 1;
 IF X > 50 THEN
  X := 1;
 IF X < 1 THEN
  X := 50;
END;
PROCEDURE YPOS (D:BOOLEAN);
BEGIN
 IF D = TRUE THEN
  Y := Y - 1
 ELSE
  Y := Y + 1;
 IF Y > 25 THEN
  Y := 1;
 IF Y < 1 THEN
  Y := 25;
END;
PROCEDURE TOGGLE;
BEGIN
 IF POS[X,Y,W] = 1 THEN
 BEGIN
  POS[X,Y,W] := 0;
  WRITE(' ');
  LOCATE(X+15,Y);
 END
 ELSE
 BEGIN
  POS[X,Y,W] := 1;
  WRITE(CHR(1));
  LOCATE(X+15,Y);
 END;
END;
PROCEDURE SET_UP;
LABEL
 CHOICE;
VAR
 I : 0..51;
 J : 0..26;
 K : 1..2;
 QUIT : BOOLEAN;
BEGIN
 QUIT := FALSE;
CHOICE:
 REPEAT
 CASE INKEY OF
  '0':BEGIN
     QUIT := TRUE;
     BREAK CHOICE;
  END;
  '1':BEGIN
     XPOS(FALSE);
     YPOS(FALSE);
  END;
  '2':
     YPOS(FALSE);
  '3':BEGIN
     XPOS(TRUE);
     YPOS(FALSE);
  END;
  '4':
     XPOS(FALSE);
  '5':
     TOGGLE;
  '6':
     XPOS(TRUE);
  '7':BEGIN
     XPOS(FALSE);
     YPOS(TRUE);
  END;
  '8':
     YPOS(TRUE);
  '9':BEGIN
     XPOS(TRUE);
     YPOS(TRUE);
  END;
  OTHERWISE (VALID KEY
  NOT USED)
  END;
  LOCATE(X+15,Y);
  IF POS[X,Y,W] = 1 THEN
   WRITE(CHR(1))
  ELSE
   WRITE(' ');
  LOCATE(X+15,Y);
 UNTIL QUIT;
END;
FUNCTION LIVE:INTEGER;
VAR
 K : INTEGER;
 L : 0..1;
BEGIN
 K := POS[X-1,Y-1,W]
      + POS[X-1,Y,W]
      + POS[X-1,Y+1,W]
      + POS[X,Y-1,W]
      + POS[X,Y+1,W]
      + POS[X+1,Y-1,W]
      + POS[X+1,Y,W]
      + POS[X+1,Y+1,W];
 IF POS[X,Y,W] = 0 THEN
  IF K=3 THEN
   L := 1
  ELSE
   L := 0
 ELSE
  IF ( K > 1 ) AND ( K< 4 ) THEN
   L := 1
  ELSE
   L := 0;
 POS[X,Y,Z] := L;
 LIVE := L;
END;
PROCEDURE CHECK;
BEGIN
 Z := W MOD 2 + 1;
 IF CHECK_KEY = TRUE THEN
  SET_UP;
 LOCATE(1,1);
 ROUND := ROUND + 1;
 WRITE('ROUND ',ROUND:4,'      ');
 Y := 1;
 FOR X := 1 TO 50 DO
  IF LIVE = 0 THEN
   WRITE(' ')
  ELSE
   WRITE(CHR(1));
 WRITELN;
 Y := 2;
 WHILE Y < 25 DO
 BEGIN
  WRITE(' ':15);
  FOR X := 1 TO 50 DO
   IF LIVE = 0 THEN
    WRITE(' ')
   ELSE
    WRITE(CHR(1));
  WRITELN;
  Y := Y + 1;
 END;
 Y := 25;
 WRITE(' ':15);
 FOR X := 1 TO 50 DO
  IF LIVE = 0 THEN
   WRITE(' ')
  ELSE
   WRITE(CHR(1));
END;
BEGIN
 ASSIGN(KEYBOARD,'USER');
 RESET(KEYBOARD);
 CLRSCRN;
 ZERO;
 W := 1;
 SET_UP;
AGAIN:
 FOR W := 1 TO 2 DO
  CHECK;
 GOTO AGAIN;
END.
```

▲



BOARDS AND BUSES

by Kevin Goldstein

Dynamic versus Static RAMs

Although it might appear at first that Hayes, with its phenomenally popular series of Smartmodems, has a virtual stranglehold on the pc modem market, the company is now starting to see some competition. In many cases, the heat is coming from modem companies that are already well established in other territories. Those of you familiar with Apples, for example, will immediately recognize the name Novation; Novation has carved out a good slice of the Apple modem market with its Apple-Cat series of modems.

Novation is trying to duplicate its success in the pc market; the instruments with which it has chosen to do battle against Hayes are the Smart-Cat 103 and 103/212 modems. As the underdog (at least in the IBM market), the company is bringing something a little different to the party. In particular, in addition to offering a programmable, auto-answer, auto-dial, 300/1200-baud modem that offers almost all (but not all—we'll see what's missing later) of the features of the equivalent Hayes, the Smart-Cat has one outstanding feature missing in the Hayes: The Smart-Cat can distinguish busy signals, dial tones, and ringing signals (called ringback), which means you don't need to blind-dial—the only choice with the Hayes—to use this modem as an auto-dialer.

Alas, the version of Smart-Cat we were sent for review got its meows confused; more specifically, it misinterpreted a ringback as a dial tone. Since that practically negates the Smart-Cat's major advantage, we checked with Novation, who agreed that the problem was a bug in programming currently being fixed.

Since the spayed—excuse, fixed—Smart-Cat should be available in September, we will be bringing you a complete report on it, as well as a few other modems, in a later installment. In the meantime, if you intend to use your modem extensively as an auto-dialer—a particularly appealing idea if you use Sprint or MCI a lot—it's likely you'll want busy, ring, and dial-tone detect capabilities. If you just can't wait for our review, make sure you try the modem you intend to buy to verify it can really do what it claims; that's particularly important if you're looking at a Smart-Cat, since for a while both the old and new versions are likely to be on the market.

RAMblings. By now most of you are probably aware that the particular kind of random access memory, or RAM, that is used in the pc is referred to as dynamic RAM, frequently abbreviated dRAM. Did you ever wonder what's dynamic about it? Well, we regret to inform you it's not that your RAMs have the kind of outgoing personalities that guarantee they'll be a hit at the PROM. Dynamic RAMs are dynamic because they must be kept constantly active; much like your video monitor, which must be constantly repainted (refreshed) to keep from losing its picture, dynamic RAMs must be constantly retold what they're supposed to remember, or, perish the thought, they'll forget everything they knew. Now is that any way to make a memory?

Most definitely. You see, dynamic RAMs have two big advantages over other types of RAMs: First, the silicon chip, which incidentally is also called the die (maybe it didn't do so well at the PROM), can be made much, much smaller in a dynamic RAM—on the order of four to six times smaller than an equivalent static RAM. The second advantage is a result of the first: In the microelectronics business, the smaller the die size, the lower the price.

The direct relationship between price and size is an important one in the semiconductor business and has to do with how many good chips a single wafer of silicon will produce. Chip batches are made by photographically etching the patterns for many identical chips on a three-to-five-inch "pancake" of silicon; the pancake, called a wafer, is chemically processed and the wafer sliced to yield hundreds of the small IC beasties.

Surprisingly enough, it's not so much that a single wafer can hold more chips that's critical in the price-to-chip-size relationship as the fact that smaller chips are less likely to have defects in them—say, from a fleck of dust. Owing to its very size, a large chip is almost sure to have a defect in it somewhere, making the whole chip useless. Thus a wafer with large chips is likely to yield only a small *percentage* of usable chips; shrink the die size of each chip and the same wafer, with the same number of chips etched on it, will yield a fairly large percentage of good chips.

So the critical element in the semicon industry is *yield*, and the way to get good chip yields is to make the die size as small as possible. (Of course, it's also necessary to follow all the rules of good housekeeping for chip makers, but we can assume any competent IC house is already pretty good at doing that.)

Before we followed this tangent into the esoterica of chip manufacturing, we were discussing RAMs and why dynamic RAMs can be so much cheaper than other types: For a given memory capacity, a dynamic RAM can be made on a smaller die than any other type of RAM memory, and thus the manufacturer will realize greater yields, which he'll pass on to you in the form of a lower price.

Of course, there's another advantage to the dRAMs' small die size: Each chip holds more memory cells. The current state of the art for production dRAMs is a capacity of 64K memory cells (K denotes the number 2^10 [two to the tenth power], or 1,024; a 64K dRAM holds 2^16, or 65,536 bits). 256K dRAMs—note that dRAM generations advance by a factor of four—are already off the drawing boards and should start finding their way into products within the next two years or so. And several com-

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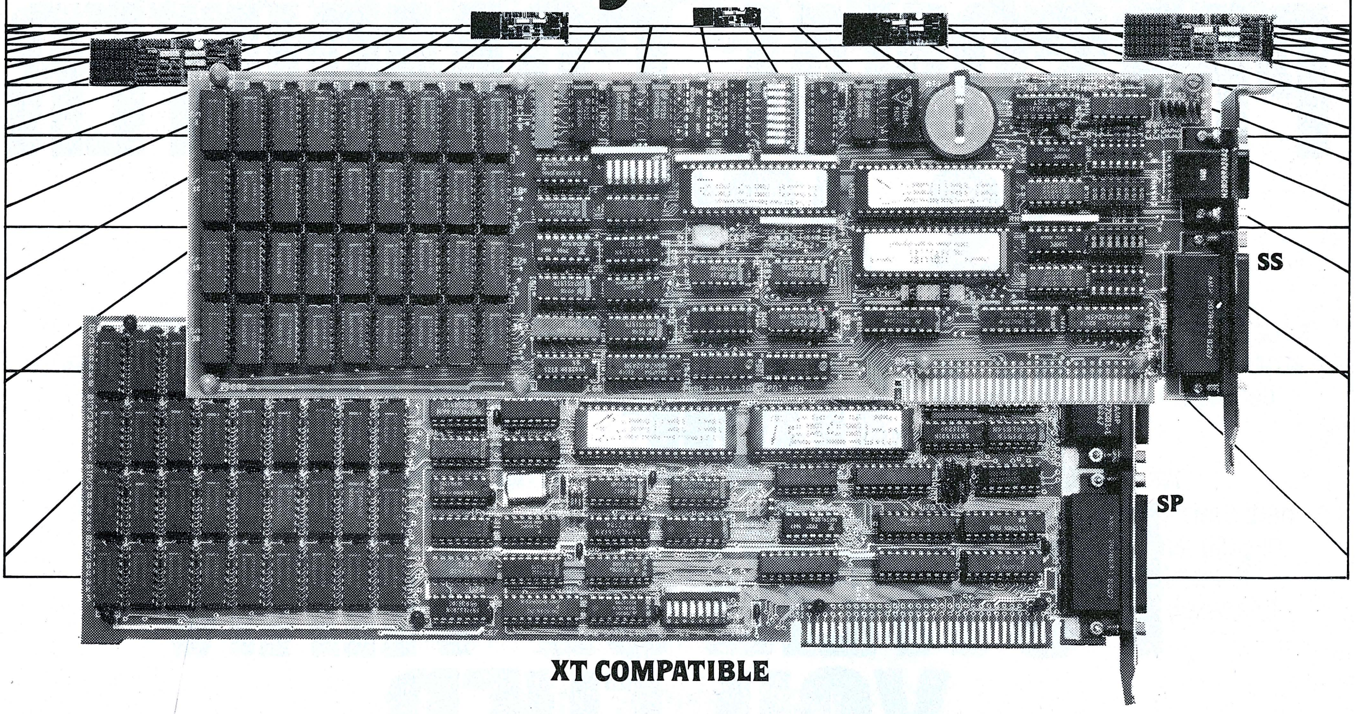

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panies are already talking about their *one-megabyte* dRAMs.

Dense-pack dRAMS. dRAMs can be made so densely because the dRAM circuit that holds each memory bit uses only a single transistor and a single capacitor. You can think of the transistor as a switch and the capacitor as a battery. The transistor switch is used to connect the "capacitor battery" to a "battery charger" (much as you would connect your car battery to a charger) and then switch the charger on. The capacitor and transistor together are called the memory cell; each cell holds one bit.

When the RAM is *powered up*, the capacitor—a.k.a. battery—is discharged; that condition represents a 0. When a 1 is written into the memory cell, the transistor is momentarily turned on and the "battery" is connected to a "charger"; when the transistor is turned off, the "battery" stays charged, and that charged condition represents a 1.

If the battery—really capacitor—were perfect, that would be the end of that. Unfortunately, a capacitor is *not* a battery; the capacitor's charge leaks off fairly fast, much as a battery will discharge over a period of time even if it's not being used. Whereas a battery will take months or years to discharge, however, the capacitor will take only a few *fractions* of a second, typically about two milliseconds (2/1000 of a second) at the most.

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The way to prevent such dementia in dRAMs is simply to read the bit every millisecond or so and then write it right back: If the bit was in its 0 condition, nothing would happen; if it was in its 1 state, the capacitor would be recharged and become good for another millisecond or so. This process of constantly reading and writing back the data is called *refreshing*; in the typical dRAM, whole groups of memory cells can be refreshed at one stroke, so the job's not quite as onerous as it seems.

But it's still not easy. Dynamic RAMs require extra support circuitry that must periodically take control of the memory chips and refresh them. That brings up *contention* problems: What happens when the processor wants to access a memory cell that the refresh circuitry is refreshing? (The processor waits.) And pretty nearly the same amount of peripheral support circuitry is required no matter how much or how little dynamic memory is in the system.

Considering that dynamic memory is as much as three to five times cheaper than the alternatives, the extra support circuitry is a good tradeoff for the lower price in large memory systems, where the support circuitry is a small percentage of the overall system. It's senseless, however, in small systems, where the amount of refresh circuitry would overwhelm the number of dRAMs being refreshed.

Situations like that call for—what else?—static RAM. Because of the internal architecture of static RAMs, they are much larger, and hence much more expensive, than their dynamic cousins: Each static RAM cell requires six transistors. Because a static memory cell contains six times the number of components as a dRAM cell, it's no surprise that the current state of the art for *production* static RAMs is at the 16K level. 64K static RAMs are about to come on line, however; a 64K static RAM will have over four hundred thousand components on a single chip. That component density is achievable only because memory chips are laid out in a very regular geometric pattern. This regularity of architecture is why memory chips pace all other types of chips according to the *device count*—that is, the amount of individual components that can be squeezed onto a single chip.

No Refreshments Needed. Static RAMs do have several advantages over dRAMs. They are quite appropriate for small systems—for two reasons. The first, mentioned above, is that the overhead of refresh circuitry becomes a large percentage of the total circuitry when the memory is small; static RAMs exact no refresh circuitry overhead. The second reason is that it's fairly easy to make static RAMs in byte-sized widths; that is, eight bits at a time can be read out of or written into a static RAM. In contrast to that, dRAMs can handle only one bit at a time. Since microprocessors access eight or sixteen bits in parallel (at a time), eight or sixteen dRAMs must be stacked up so they can be accessed simultaneously; each dRAM will then contribute a single bit of the eight-bit word. Using static RAMs, a small system of only 8K bytes is perfectly feasible; it would be implemented as a single 64K static RAM, with eight bits being accessed at a time. A 64K static RAM system configured to spit out eight bits at a time is referred to as 8K x 8.

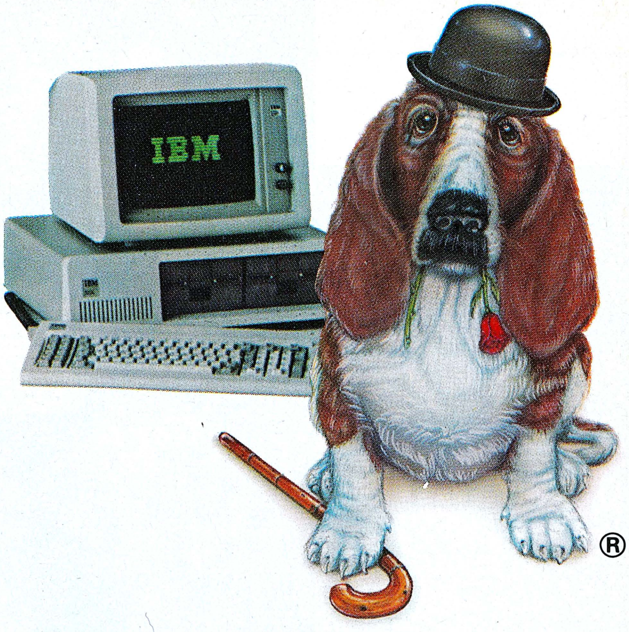
The situation is a bit different if we're using dynamic RAMs; dRAMs are organized 64K x 1. Since each dRAM contributes only one bit of the total byte, we need a minimum of eight dRAMs. That means the smallest system that can be built using 64K dRAMs is 64K bytes. Likewise, the smallest memory system that's practical using 16K dRAMs is 16K bytes.

The input-output constraints of dRAMs—only one bit at a time—were probably significant factors in IBM's decision to go with the eight-bit external bus of the 8088 in preference to the sixteen-bit bus of the 8086. Had Big Blue chosen the 8086, the minimum memory system would have required not eight but sixteen dRAMs in parallel, thus doubling the size of the minimum system. IBM wanted its minimum system to be as minimal as possible, which meant that those extra eight dRAMs were expendable. Note that this problem wouldn't have existed if dRAMs were available in 32K x 2-bit configurations; the company could then have used eight such chips, resulting in a memory of 32K sixteen-bit words, which is of course still 64K bytes.

Rumor Department. Look for Peanut, IBM's low-priced consumer computer, to appear the first part of this month, probably at a price between $600 and $900. Rumor has it that a book on the Peanut, not published by IBM, will be released at more or less the same time the machine is announced. The book, written by a prominent West Coast author, will be distributed by a prominent East Coast publishing firm for a prominent Northwest software (and now book) publisher.

Rumor also has it that the Peanut will use an infrared link rather than a cord to connect the keyboard to the system unit. That's a little hard to believe, but it would be nice. If it's true, you can bet an "upgrade" (downgrade?) will be offered for the pc. Time will tell, but don't hold your breath. ▲

All work, and no play, makes Charlie dull.



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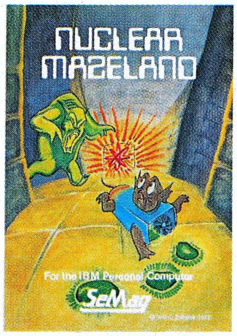
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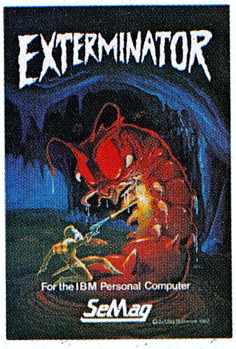
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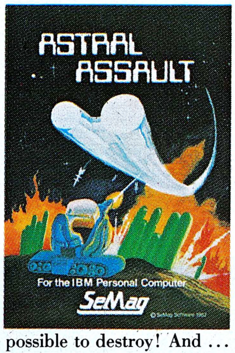
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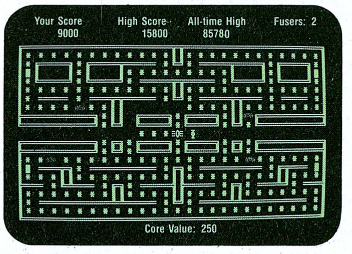
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15800
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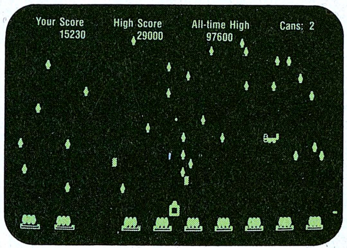
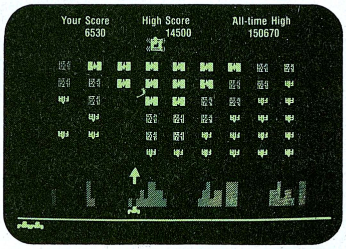
85780
Fusers: 2
Core Value: 250


Your Score
15230
High Score
29000
All-time High
97600
Cans: 2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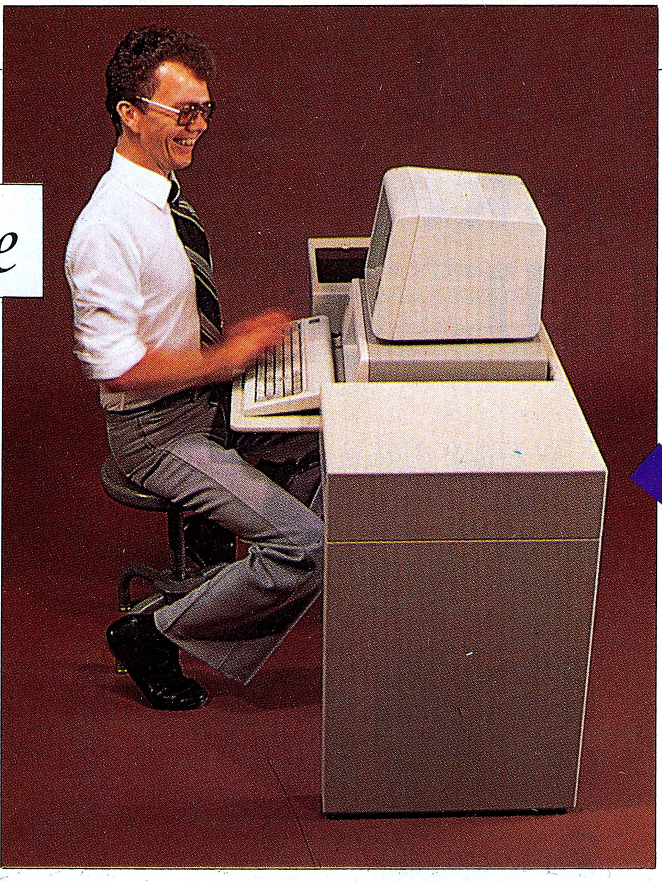
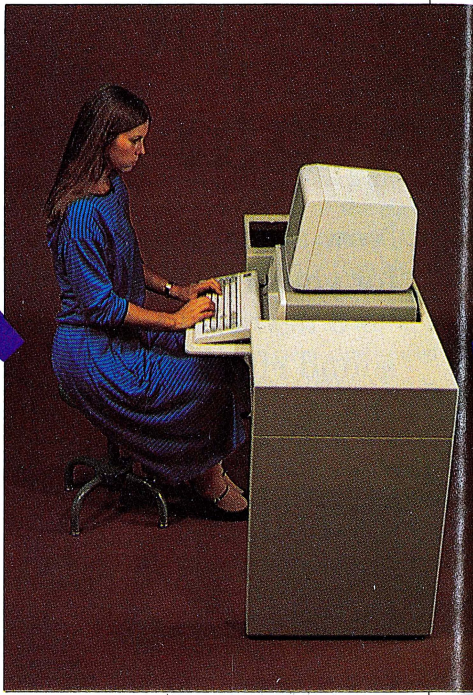
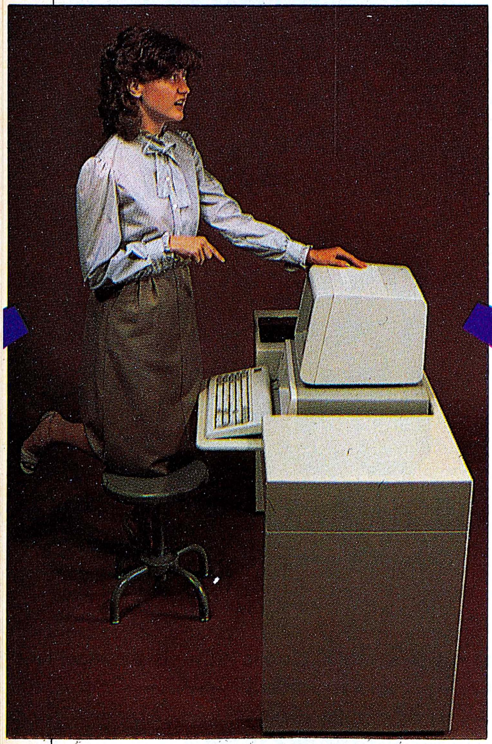
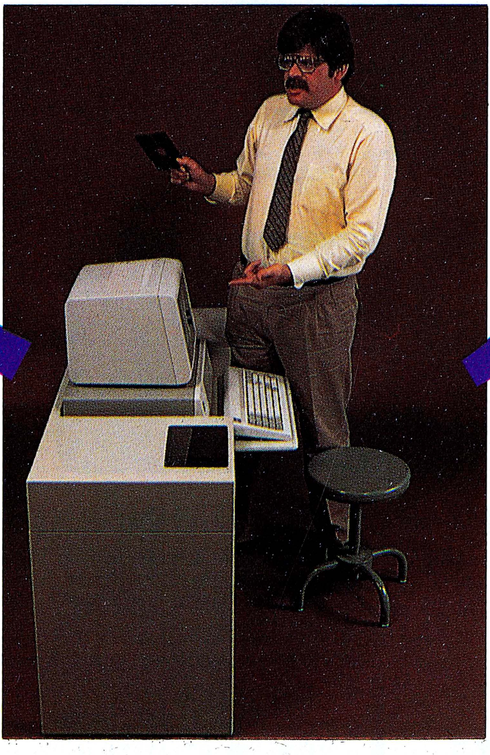
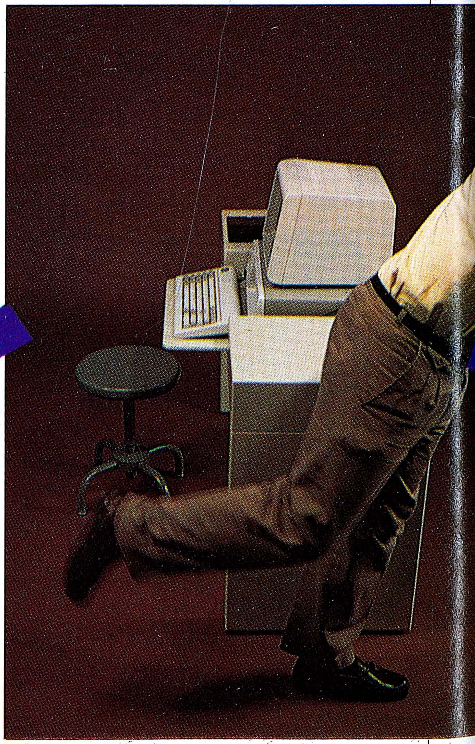




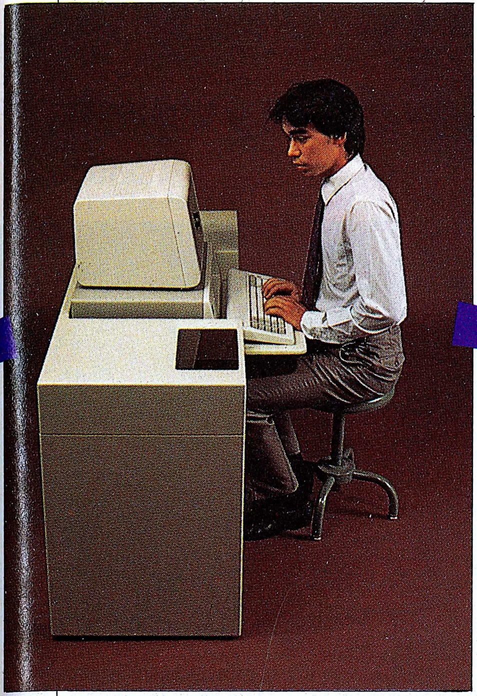


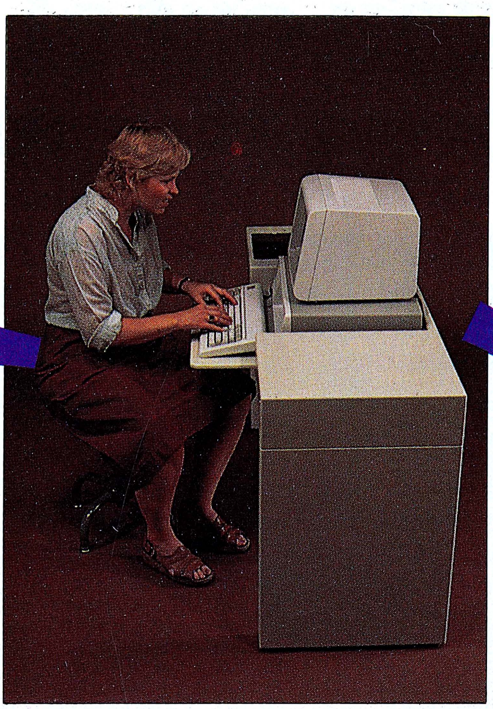


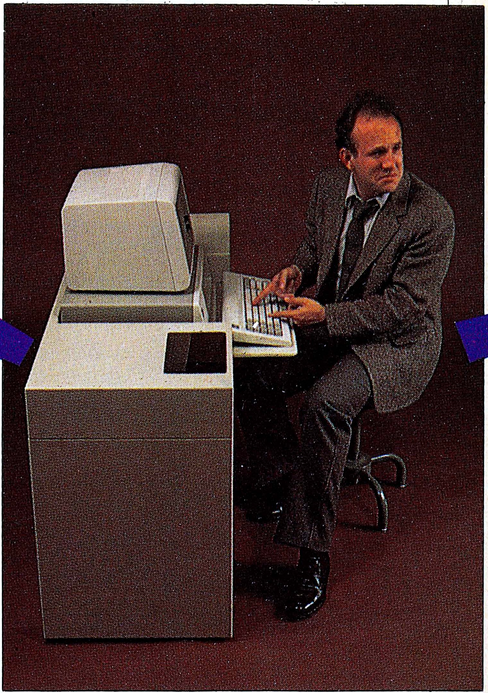


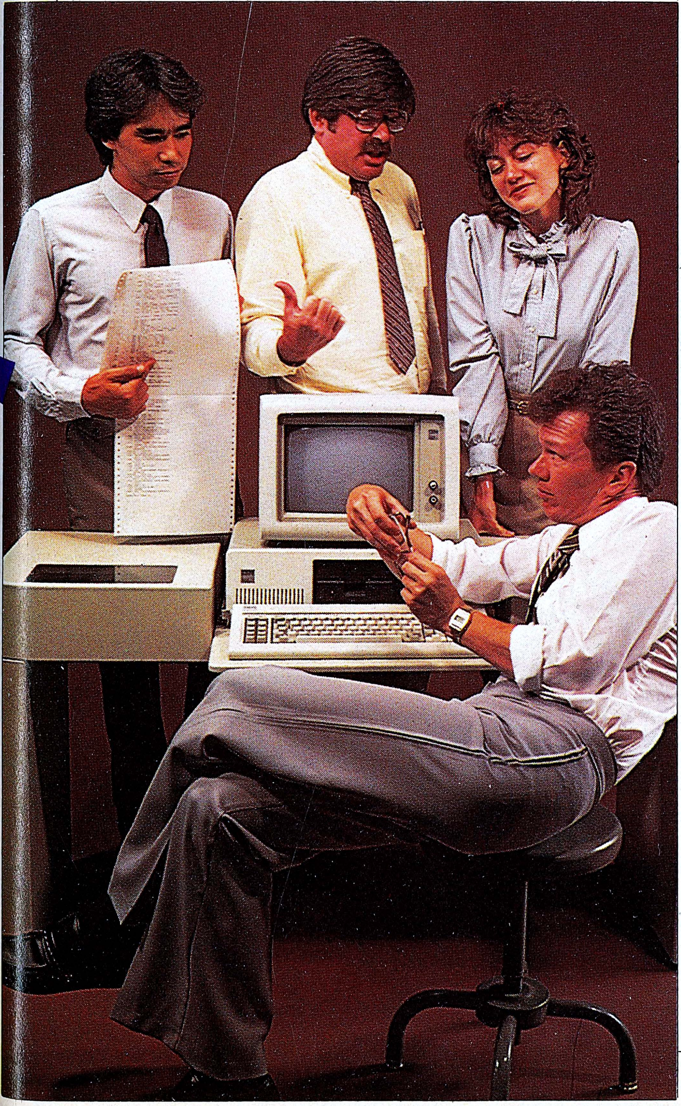
by Bruce Churchill

The following is the third in a series of articles excerpted from the book Communications and Networking for the IBM PC, *by Larry Jordan and Bruce Churchill, and published by the Robert J. Brady Co.*









A PRIMER ON NETWORKING

This month we begin our survey of the first three local area network systems to be implemented on the IBM Personal Computer: PCNet, Omninet, and Etherlink. In this installment we'll focus on PCNet, from Orchid Technology (487 Sinclair Frontgage Road, Milpitas, CA 95035; 408-942-8660). Discussion of Omninet and Etherlink will follow in October and November.

PCNet System Overview. Designed specifically for the pc and its native operating system, PC-DOS, PCNet is classified as a distributed bus, baseband local network with CSMA/CD access. It is capable of addressing up to 64,000 devices and therefore, from a physical standpoint, can accommodate the demands of most network layouts. PCNet also supports many IBM pc plug-compatible computers, such as Compaq, Colby, Columbia MPC, Eagle 1600. It

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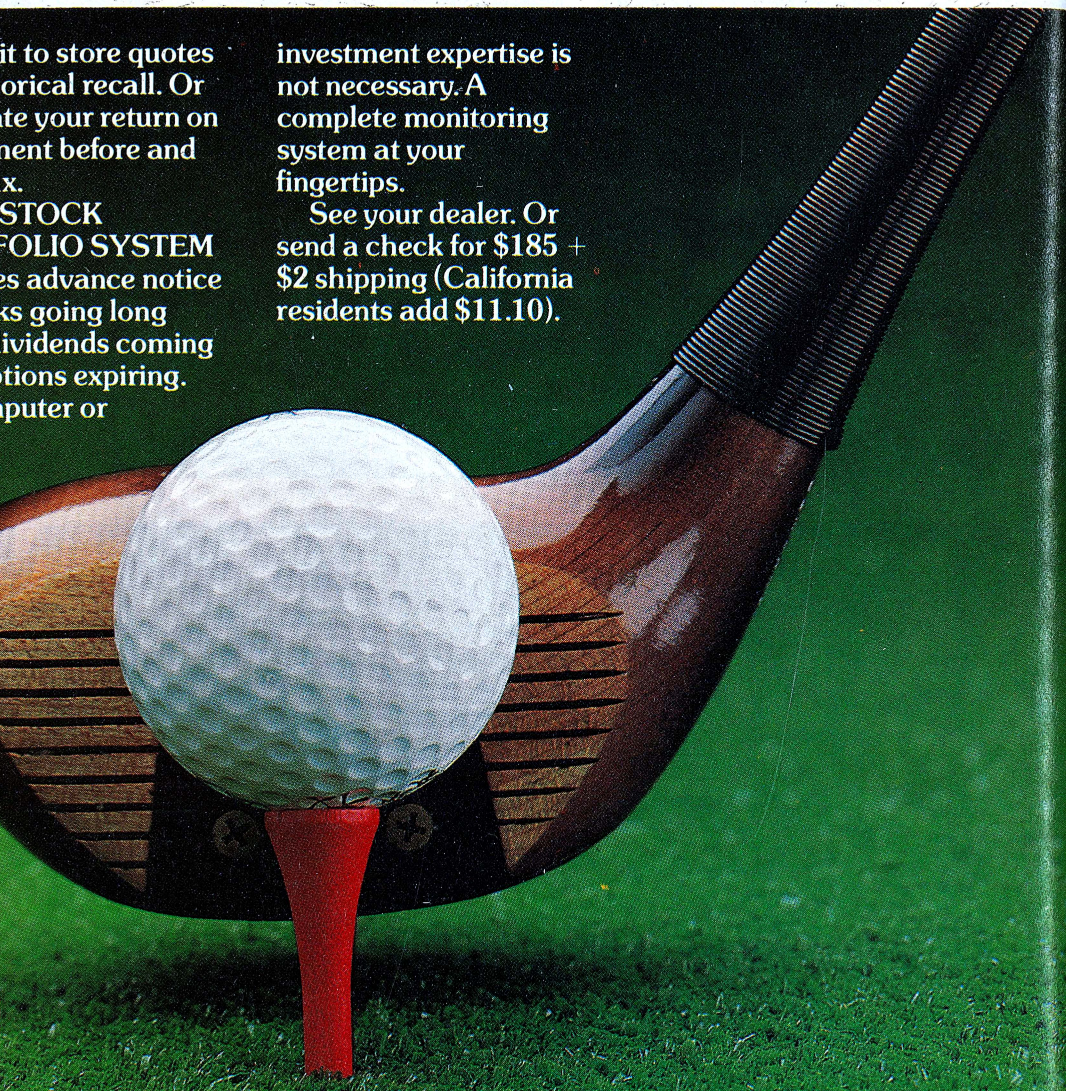

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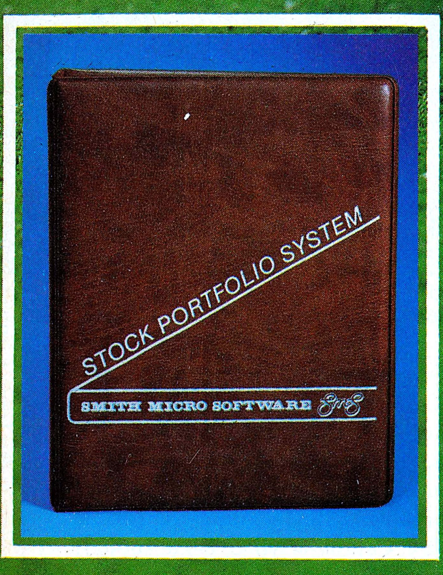

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is compatible with PC-DOS versions 1.1 and 2.0.

PCNet software interfaces directly with PC-DOS, making the network look to the operating system like another input/output device. No servers are required on this network; instead, shared printers, modems, and hard-disk devices are connected directly to designated pcs. PCNet supports any plug-compatible hardware that's compatible with PC-DOS.

PCNet Hardware. The PCNet hardware consists of a single network adapter card that plugs into one of the available expansion slots on each pc in the network. A BNC-type connector on the back of the board plugs directly into the network cable via an inexpensive T-connector.

The network cable is a standard 75-ohm CATV-type coaxial cable. It runs end to end throughout the area where the networked pcs are installed. Depending on cable rating, wire runs of up to 7,000 feet are possible, allowing an entire work area to be prewired and pcs to be added to the network or easily moved within it. Hooking up the cable is almost as easy as plugging in the power.

The PCNet adapter card contains proprietary CSMA/CD logic to control access to the network by attached pcs. A nominal serial data rate of one megabit per second provides high-speed operation and optimizes direct memory access operations with the pcs in the network.

PCNet Software. Each PCNet adapter card comes with software that integrates the network into PC-DOS. This DOS interface is designed to enable standard single-user pc applications to use the network without change. With only minor program modifications, more advanced multiuser systems can be developed from single-user applications.

The three main features of the DOS interface are *disk sharing*, *file locking*, and *remote execution*.

Disk Sharing. Disk sharing allows pcs to share hard disks or floppy drives installed in other pcs. The shared disks appear to the user to be locally attached. For example, if a pc has one disk drive and shares a hard disk via the network, a user can access the local floppy as drive A and the shared disk as drive B, C, or D, as shown in figure 1. Drives B, C, and D then become volumes on the shared hard disk. Any future reference to B:filespec, C:filespec, or D:filespec during program or data access will activate the hard disk as if it had been attached to the requesting pc. The assignment of drive designations to local and shared drives is completely flexible; a user's drive A doesn't have to correspond to his local floppy drive. Figure 2 shows a typical PCNet installation

PCNET INSTALLATION AND COMPONENTS

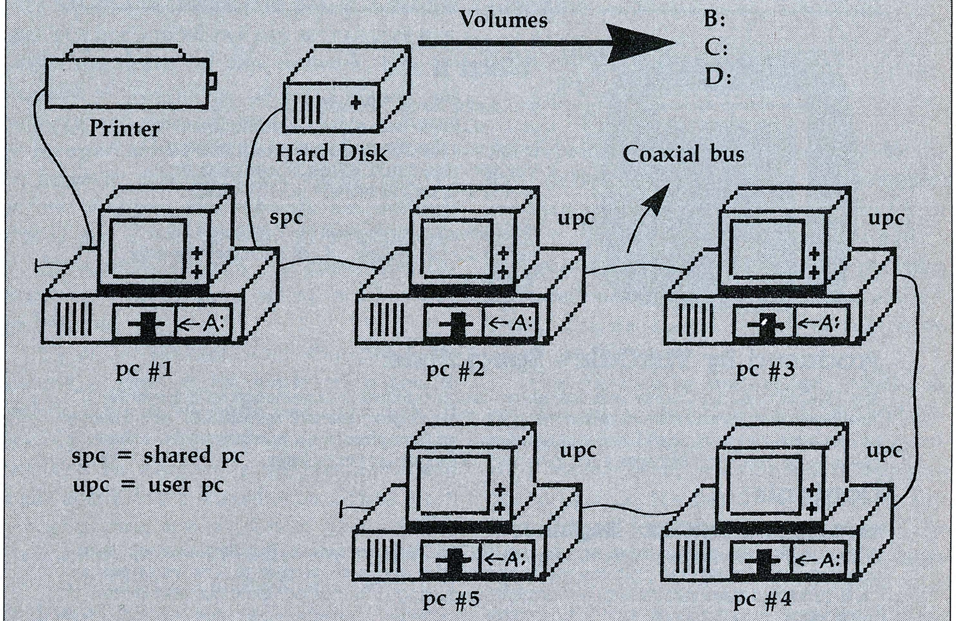
Volumes
B:
C:
D:
Printer
Hard Disk
Coaxial bus
spc
upc
upc
←A:
pc #1
pc #2
pc #3
spc = shared pc
upc = user pc
upc
upc
pc #5
pc #4

Figure 1

PCNET I WORD-PROCESSING INSTALLATION

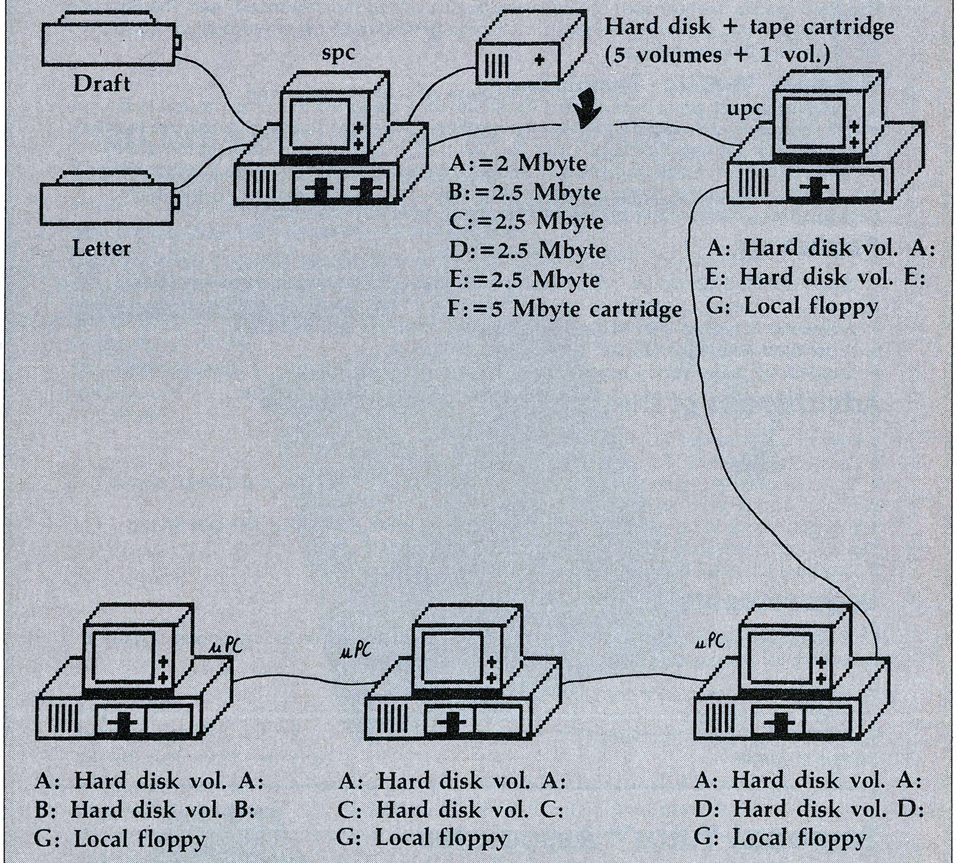
Draft
Letter
spc
Hard disk + tape cartridge
(5 volumes + 1 vol.)
A:=2 Mbyte
B:=2.5 Mbyte
C:=2.5 Mbyte
D:=2.5 Mbyte
E:=2.5 Mbyte
F:=5 Mbyte cartridge
upc
A: Hard disk vol. A:
E: Hard disk vol. E:
G: Local floppy
uPC
uPC
uPC
A: Hard disk vol. A:
B: Hard disk vol. B:
G: Local floppy
A: Hard disk vol. A:
C: Hard disk vol. C:
G: Local floppy
A: Hard disk vol. A:
D: Hard disk vol. D:
G: Local floppy

Figure 2.

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d. Logical Functions @TRUE, @FALSE, @AND, @OR, @NOT, @IF, @ISNA, @ISERROR
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and logical drive relationships.

The benefits of disk sharing are several. First, it provides each user with the capacity of a hard disk at the lowest possible cost. Second, it simplifies the backup process; only one hard drive requires backing up, and the one backup can cover the data from all users. Third, each pc can perform initial system boot with only one floppy drive. Finally, disk sharing allows a user to examine the data files of other users and to transfer files between shared and local (floppy) storage. The disk sharing interface has the inherent advantage of being able to work with any hard disk that's compatible with the IBM pc, whether internally or externally mounted.

File Locking. In order to implement a multiuser multiple-pc application that shares common data files, a mechanism must be provided to ensure that these files are accessed by only one user at a time. The denial of access to a file that has been opened is known as file locking. Access denial can be specified at the file or the record level. The term unlock refers to the removal of the access denial when a file is closed.

Since PC-DOS does not support file locking (remember, it is a single-user system), the DOS interface includes function calls to lock and unlock files by name or by name and record number. These assembly language function calls can be used from within an application program to provide the required file-access protection. If two or more pcs should try to modify a common file at the same time, one will simply wait until the other is finished before proceeding. This is essentially the same principle as is used in installations running multiuser operating systems.

Another means of file locking is also provided. Three utility programs that can be executed from a batch file are supplied; they afford a degree of protection at the operating-system level without requiring modification of an application program.

Remote Execution. The creation of a truly distributed processing system with PCNet and PC-DOS requires that there be a way of sharing expensive resources, such as printers, modems, and plotters. There must also be a way of performing what amounts to multitasking operations. The DOS interface manages all this by means of a feature called remote execution.

Remote execution allows a user on one workstation to run a command on another pc as if the command had been entered on that remote keyboard. When the command has been executed, the remote caller hears a short beep on his pc. The PCNet remote execution feature does not provide the requesting user a view of the process requested.

In PCNet, a pc with specialized peripherals can act as an execution server for other pcs and can print files, assemble programs, or plot graphs while the requesting user performs other work. As long as the host user is not trying to do an I/O operation involving the same peripheral, network access is transparent. Software compatibility is guaranteed, and any hardware that's plug-compatible with the pc can be remotely accessed.

This scheme has distinct limitations. In order to work properly, any command issued remotely must terminate with a return to DOS. For example, a command to run *VisiCalc* will not work with the remote execution feature, because there is no way to return to DOS without user intervention from within *VisiCalc*. Furthermore, any program that requires interaction with the user will not work under remote execution. Batch processing jobs, however, will work properly, provided that the batch file is constructed to return to the DOS prompt upon completion. Any program that takes a file, processes it, and rewrites it to an output device should also work; this category includes such typical applications as sorts, compiles, and assemblies.

PCNet System Specifications and Operation.

Hardware Specifications. The hardware adapter card communicates with the pc system board by means of interrupt lines, DMA channels, and I/O ports. In order to avoid contention with such devices as floppy drives and hard disks, the adapter card uses those lines, channels, and ports not used by any other peripherals. One result of this allocation is that DMA access can be made only to the lowest 64K of RAM. The impact of this restriction is not significant from a practical standpoint.

Maximum cable length is determined by signal loss: for RG-59B/U coax, the maximum length is 3,000 feet. The heavier RG-11/U coax permits a cable length of up to 7,000 feet but is more difficult to install. Cable taps and terminators are standard BNC hardware, available at any electronics supply store. There are no restrictions on where expansion pcs can be tapped into the main bus cable. The T-connector tap on the main bus cable is designed to attach directly to the BNC connector on the adapter card at the pc's back panel.

Software Operation. The operating system for the network is supplied as a patch to the existing PC-DOS code. The network software uses sixteen interrupt service addresses allocated to but left unused by standard PC-DOS. Pcs in a network must be initialized as either shared pcs or *user* pcs. To simplify command and software references, each shared pc and drive volume is assigned a name consisting of up to fourteen characters.

The sharing features of the PCNet software impose some restrictions. In general, user pcs can access shared pcs, but neither user pcs nor shared pcs can access user pcs. Given the design of this network, this restriction is reasonable; user pcs should not be interfered with arbitrarily. Also, a shared pc may not access another shared pc directly; however, this restriction will be removed in later versions. If a network has multiple shared pcs, a user pc with access privileges to the appropriate pcs can copy files between any two of them, acting in effect as a go-between.

Upon initialization, each shared-pc user assigns a name to his workstation and to each volume on the attached hard disk (if one is present); floppy drives on a shared pc can also be assigned a volume name and made available for shared access. Next, each shared-pc user enters a list of user pcs that may access his pc. Finally, the shared-pc user designates the allowed users and their read/write access for each shared volume. Each operator of a user pc now enters the names of the shared pcs he wishes to access. The user-pc operator must also map his local drives and all shared drives to volume designations (PC-DOS allows drives A through J to be assigned).

In order to use a shared printer or modem, a user-pc operator enters the command

```
ASSIGN device_name TO
sPC_name device_name
```

All subsequent file I/O commands to the local device (Lpt1: or Com1:, for example) are then executed on the shared printer or modem attached to a shared pc (pc number 1 in figure 1). PC-DOS version 2.0 provides increased flexibility for I/O device assignment, making shared peripheral use even easier on PCNet.

The file-locking mechanism, which, as you'll recall, is used to allow concurrent access to shared files, is accessible at the operating system level or from within application programs. It's based on a symbolically named lock, known as a semaphore. The semaphore is a sixteen-byte identifier large enough to contain a full eleven-byte filespec and a five-byte record number. A typical semaphore looks like this:

```
filenameext00055
```

Since the locks apply to files on shared

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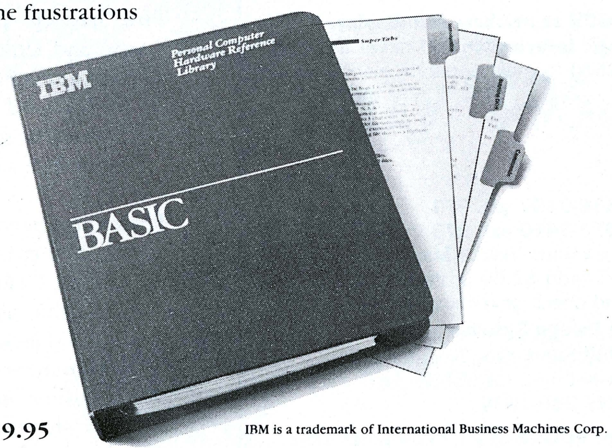

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```
A >COPY  CON:  ACCESS.BAT
LLOCK RECORDS.DFB           Rem Test file and lock when free
DBASE                       Rem Enter dBase and "Use" RECORDS
UNLOCK RECORDS.DBF          Rem Release lock on RECORDS.DBF
```

Figure 3.

Type	Call	Description
Type 0	LoopLock (sPC_name, lock_name)	• Lock the given name at the given sPC; if already locked, wait and try again, and keep trying until free. • Return codes: "OK," "sPC down," "bad arguments"
Type 1	Lock (sPC_name, lock_name)	• Attempt to lock the given name at the given sPC • Return codes: "OK," "lock in use," "sPC in use," "bad arguments"
Type 2	Unlock (sPC_name,lock_ name)	• Attempt to unlock the given name at the given sPC • Return codes "OK," "lock not found," "sPC down," "bad arguments"

Table 1. PCNet Function Calls

mass-storage devices, they're maintained in RAM on all shared pcs having those resources. The locks can be set, reset (cleared), or tested by the function calls discussed earlier. Table 1 lists the available function calls with the activities they perform and their possible results. Certain restrictions apply to the use of this concurrent access technique: If any user program creates a new file or changes the length of an existing file, the entire volume containing that file must be closed to multiple access. The full sixteen-byte semaphore can be used to lock a record on indexed files, providing that the five-digit record number is considered to be the first five characters of a designated key field. (A recent enhancement to PCNet has increased the semaphore size to thirty-two bytes to accommodate larger or multiple index keys.)

The utility programs Llock.com, Lock.com, and Unlock.com provide file-access control at the PC-DOS level. These programs are designed to be used within batch files, as figure 3 at the top of the page (which uses *dBase II* and a file named Records.dbf) shows.

The choice between Llock and Lock depends on whether the user wants a one-time request to lock a file (Lock) or a continuous loop request that stays in effect until a file becomes free (Llock).

PCNet's remote execution mode allows a user-pc operator to execute a DOS command on a shared pc, provided that that operator has been placed on the shared pc's access list. The remote command line looks like this:

```
RE [sPC_name] <command string>
```

The shared pc name is optional; if specified, it sends the command string to the designated shared pc for execution. Otherwise, the target shared pc is determined by the network software, using the list of sPCs with their volume assignments. If, during system startup, one volume has been designated to be a network default volume, that volume will execute all commands for which no shared pc name has been specified.

For example, consider the following DOS *copy* command typed on a user pc:

```
RE COPY B:FILENAME1 C:FILENAME2
```

In this case, assume that drives B and C are assigned to the shared hard disk. If the network default volume were initialized as C, the command would take effect on the shared pc that contained volume C, since no shared pc name was included in the command. File locking against multiple access is preserved on remotely executed commands, so that an operator cannot use the system to bypass volume or file protection.

PCNet Application Example. The example we'll consider is a four-user word processing system that shares a hard disk and letter-quality and draft-quality printers. We'll assume that this hard disk can be partitioned into multiple volumes.

This system consists of five pcs. One acts as a shared printer/mass-storage workstation; the other four are used by operators to input and modify stored text. The shared pc contains a disk drive, a 12-megabyte hard disk, and a 5-megabyte tape cartridge unit for backup. The hard drive is formatted into one 2-megabyte public volume and four user-owned volumes, each with a 2.5-megabyte capacity; the user volumes can hold about sixteen hundred pages of text apiece. The shared pc also contains ports to which the two printers are attached: The volume-to-disk assignments (or mapping, as the

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Volume	Drive	Contents
A	Fixed 2 MB	Common programs, including the word processor, mail merge program, spelling checker, and so on. Read only by all uPCs.
B	Fixed 2.5 MB	Read/write file storage for user #1
C	Fixed 2.5 MB	Read/write file storage for user #2
D	Fixed 2.5 MB	Read/write file storage for user #3
E	Fixed 2.5 MB	Read/write file storage for user #4
F	Cartridge 5 Mb	Used exclusively for backup. Can back up two users at a time.
G	Floppy	Used to boot and copy programs to shared volume A.

Table 2. Shared pc hard-disk volumes—word processing example.

Local Volume	Mapped Drive	Contents
A	PCNet shared volume A	Volume containing read-only programs
B	PCNet shared volume X (X=B, C, D, E)	Volume assigned as read/write storage for this user
C	Local floppy drive	Volume for local storage

Table 3. User pc disk volume mapping—word processing example.

process is sometimes called) on the shared pc are shown in table 2.

Each word processing operator's user pc is configured with only one floppy disk drive, used primarily to boot the system. These user pcs have a volume-to-disk drive mapping, as shown in table 3.

The shared-pc and user-pc assignments for this example are illustrated in figure 2. Since volume A on the shared hard disk contains the common application programs, all users need access to this volume; volume A is also designated the network default volume. In addition to the word processing software, spelling checker, form-letter program, and so on, drive A may also contain universal boiler plate files; each user on the system may have his or her own boiler plate files as well. Each word processing operator will also have a dedicated volume for the storage of his own document files.

PCNet Economics. So what does it cost to install a system like the one just described?

A starter system is available. It consists of two network adapter cards, two BNC-type T connectors, one finished twenty-foot coaxial cable with two 75-ohm terminators, one distribution disk per adapter card to use in initializing and managing shared pcs and user pcs, and one manual. This is an entry-level system—a complete kit for networking two pcs.

Prices for individual components are listed below in figure 4.

An eight-member network typically might require the hardware and software shown in figure 5 in the cost breakdowns at the bottom of the page.

Communications cost of this example network is $742 per user. These figures don't include the costs of any network peripherals—such as a hard disk. Since PCNet uses any pc plug-compatible peripherals, these costs will vary widely. Inclusion of electronic mail and print-spooling software (to be released soon from PCNet) would increase the network costs by $750 and $600 respectively.

Assuming the base case of a 760-foot prewired installation with a two-workstation starter kit (costing $1,762), the cumulative costs for additional workstations appear in figure 6.

Next month: Omninet. ▲

PCNet adapter card (with BNC connector and user pc software)	$ 695
PCNet finished twenty-foot coaxial cable	$ 20
PCNet finished fifty-foot coaxial cable	$ 29
PCNet custom RG59/U coaxial cable	$ 44 + .30 per foot
PCNet custom RG11/U coaxial cable	$ 44 + .60 per foot
Tri-hex tool used for BNC insertion	$ 200

Figure 4.

1 starter kit	$1490
6 PCNet adapter cards plus BNC hardware	$4170
760 feet of custom RG59/U coaxial cable (measured length of bus cable plus 50 percent for corners, routing, taps, and so on)	$ 272

Total	$5932

Figure 5.

Workstations	3	4	5	6	7
Cumulative cost	$2457	3152	3847	4542	5237
Cost per user	$819	788	769	757	748

Figure 6.

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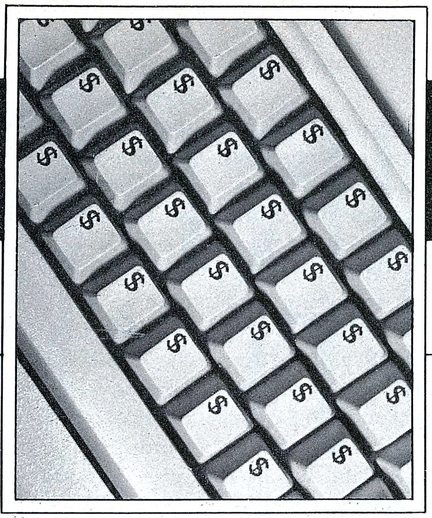


MICRO FINANCE

by Ken Landis and Douglas J. Weber

Taxes: The Advantages of Buying versus Renting

In America there are two immutable financial laws. First, without careful planning and analysis your taxes for a given year will exceed your wildest expectations. Second, if you file a tax form 1040 (the long form) and itemize your deductions, your return will receive the same degree of scrutiny as will evidence in a capital case.

One of the most common methods of reducing tax liability is to buy a dwelling and live in it. The Internal Revenue Code, which is the tax law of the land and which affects almost every financial decision we make, provides a host of incentives to make us consider real property as a means of reducing tax liability, gaining equity, and perhaps even realizing some profit.

This month we'll look at some of the tax considerations involved in the decision to buy real property. We'll develop a spreadsheet model to assist in the analysis.

The first area we need to explore is net cash flow. How much do we have coming in, and how much is going out?

Meet Mr. Thomas Cory. Cory is single, has no dependents, and manages the paste-up department for Superior Graphic Corporation. He earns $1,800 a month after deductions for federal, state, and local income taxes, Social Security, and health insurance.

The listing at the right shows Cory's monthly income statement. The statement is broken down according to how much money he receives every month and where it comes from, and how much he owes and where it goes. The "Net Monthly Cash Inflow" at the bottom represents Cory's financial "leftovers."

Based on these estimates of monthly income and expenses, Cory has $126.34 per month available for savings or additional expenditures. His personal income statement gives him a starting point from which to begin his analysis of whether to buy or rent. Construct your own personal income statement to see where *you* stand.

Income Analysis. Let's analyze Cory's income statement. His income, like that of most people, is subject to federal, state, and local taxes. To reduce his tax liability, Cory would want to *expense*, or deduct, any of his monthly cash outflows that he can, without running afoul of the tax laws. What's a deduction?

A deduction is an expenditure, specifically allowed under tax law, that is subtracted from total and/or gross income. Total income is the sum of all your taxable sources of income. Adjusted gross income is your total income less certain allowable downward adjustments. For the complete list of adjustments, look at page 1, lines 23 through 30, of federal form 1040.

By reducing total or adjusted gross income, we reduce our potential tax liability. For example, if you're in a 40 percent marginal tax rate bracket (which means that for each additional dollar you earn you incur a forty-cent tax liability), every dollar you deduct saves you forty cents of federal income tax. Additional savings are achieved on state and local income taxes.

Monthly net income (salary)	$1,800.00
Interest income from Money Market Fund	62.34
Total net monthly income	1,862.34
Monthly rent	485.00
Monthly utilities	150.00
Renter's insurance (pro-rated)	30.00
Monthly car payment (interest and principal)	201.00
Car insurance (pro-rated)	50.00
Memberships (raquetball club)	20.00
Food	200.00
Miscellaneous expenses	600.00
Total expenses	1,736.00
Net monthly cash inflow	$126.34

The tax tables have a built-in base called the *zero bracket amount* (ZBA). This is a flat dollar amount that's determined by your filing status—single, married filing jointly, married filing separately, or head of household. If you're to benefit from your itemized deductions, the total of these deductions must exceed the ZBA for your filing status. The ZBA compensates those individuals who don't have enough deductions to itemize on their tax returns.

As Cory's income statement now stands, his only deductible expense is the interest portion of his car payment. Most people would also have interest payments on their credit cards or on other forms of consumer credit. Let's assume that Cory's total interest expense for the year is $1,769.00. The zero bracket amount for his filing status (single) is $2,300.

His total deductions thus are less than his zero bracket amount by $531, and there's no benefit for him to gain by itemizing deductions. But let's see if by buying property he can change the picture.

Cory's current monthly rent is $485. These rental payments are not deductible, so they don't reduce his taxes. Furthermore, since he's renting, these payments don't contribute to the build-up of equity.

If Cory were to borrow money (in the form of a mortgage), he would have additional deductions. He would also be building equity in the property and, perhaps, reducing his tax burden.

The Mortgage Payment. A mortgage payment is comprised of both principal and interest. The principal portion of the payment builds equity; by repaying money borrowed, it slowly buys the property. The interest component, which is initially the majority of the monthly payment, is mostly, if not totally, deductible from Cory's income. Although as a homeowner Cory will prob-

---

This article is not intended to render tax advice. However, references to pretax and after-tax calculations are essential to the analysis presented within the article.

Mr. Landis's coauthor this month, Douglas J. Weber, is a tax manager in the Saint Louis office of Peat Marwick.

ably have to pay real estate taxes, these are also potentially deductible. While the combined mortgage and real estate tax payment may exceed his rent payment on a pretax basis, the deductibility of interest and real estate taxes may make the after-tax cost to him equal to or less than his present rent payment.

Let's take another look at part of that income statement. Cory's monthly rent is $485. His net monthly cash inflow is $126.34. Theoretically, if he didn't increase any of his other monthly expenditures or take on any new ones, he could afford on a pretax basis to pay as much as $611.34 ($485.00 plus $126.34) for the combination of principal, interest, and property tax escrow payment. This assumes that his insurance premium remains the same. Remember, this is on a pretax basis. Now let's look at the after-tax situation.

Assume that Cory buys a house and his monthly mortgage payment, including principal, interest, real estate tax, and escrow payments, is $600. At the average market interest rate today, at least $450 per month would be deductible interest expense during the early years of the mortgage. (As the mortgage matures, the principal component will increase and the interest component will decrease, because interest is computed on the unpaid mortgage loan balance.)

We'll assume that Cory's property taxes come to $100 per month. If his total mortgage payment is $600, comprised of his interest charge of $450 and real estate taxes of $100, then $50 represents repayment of principal. The real estate taxes and any required escrow payments would be determined by conditions prevailing where Cory lives. The $600-per-month mortgage and tax payment provides Cory a potential $500-per-month deduction.

As mentioned earlier, Cory's zero bracket amount is $2,300 per year. The deductions for the house alone, assuming constant interest on the mortgage payment, will be approximately $6,600 per year—more than enough to qualify him to itemize. The approximate benefit from incurring this $6,600 deductible interest expense is $4,300 (the difference between $6,600 and the zero bracket amount) multiplied by the marginal tax rate (40 percent). That comes to $1,720.

Compare this figure to Cory's rent. He has been paying $5,820 per year and has been unable to deduct a penny. Nor has he been building any equity. Even though his total mortgage payments are $7,200 a year after taxes, his net out-of-pocket cost (assuming still a 40 percent tax bracket) is $5,480—which is $340 less per year than his rent.

If Cory buys the house he will reduce his annual housing cost by $340. Additionally, he'll be building equity in the property; as a renter he's been kissing his money good-bye. By exceeding the zero bracket he'll also have the opportunity to deduct various other expenses, such as doctor bills, contributions to charity, and the various state and local taxes withheld from his gross pay.

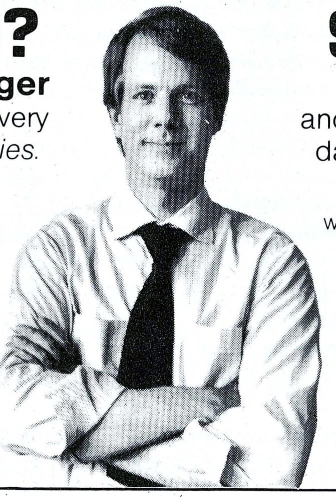
The most convenient way for Cory or anyone else to analyze the different effects of buying a residence (versus renting one) is with the help of a spreadsheet package. The model that accompanies this article was developed in *1-2-3*, but any spreadsheet that includes the logical *if* function will serve. The template on page 69 was designed specifically for the analysis of rent-versus-buy decisions. You can also use it to check your assumptions about existing property deductions. If you choose to modify any of the formulas, though, be careful that you adjust the model correctly. One small mistake can create a colossal headache for you later on.

Our template shows Cory's expense estimations in column D. The calculations used for his decision appear in rows 29 through 61. Results, which are all in column C, are shown in the figure as formulas (using *1-2-3*'s *text* format). As you can see, the formulas are not complicated.

The value of the template is twofold: First it rapidly performs the calculations, permitting you to analyze more alternatives. Second, it allows you to analyze each potential option in the same fashion. This uniformity of analysis will help you make a better, more informed decision.

The major thrust of the template is to help you determine how much of a house you can afford to buy. It is not designed for comprehensive cash-flow planning. Rather, it should help you decide if you can afford to buy instead of renting.

The Variables. After you've built the model, you'll need to gather the information required to operate it—the variables. The easiest way to estimate your marginal tax rate is to look at the instruction booklet that comes with your tax return packet. Tax rate schedules X, Y, and Z show the approximate marginal tax bracket for each filing status, based on the amount of taxable income—which, for the 1982 returns, is line 37 of federal form 1040, line 16 of form 1040A, or line 7 of form 1040EZ. Line 37 of Cory's 1982 federal return would have been $30,598. If we look at tax rate schedule X, which is for taxpayers with single filing status, we see that Cory's taxable income lies within the over-$28,800-but-under-



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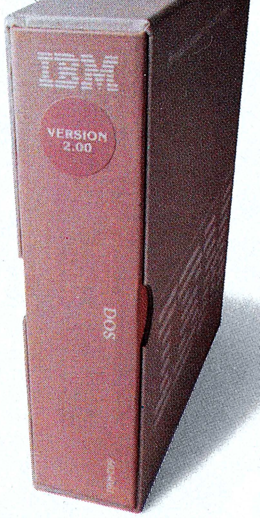

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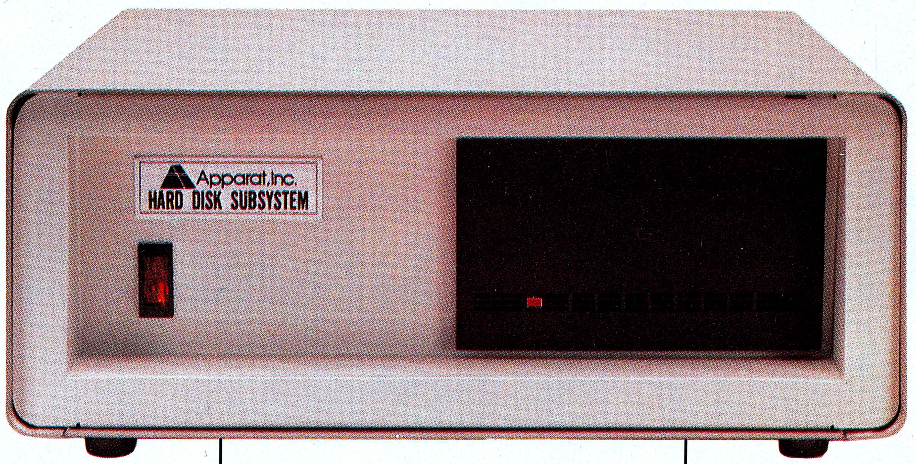

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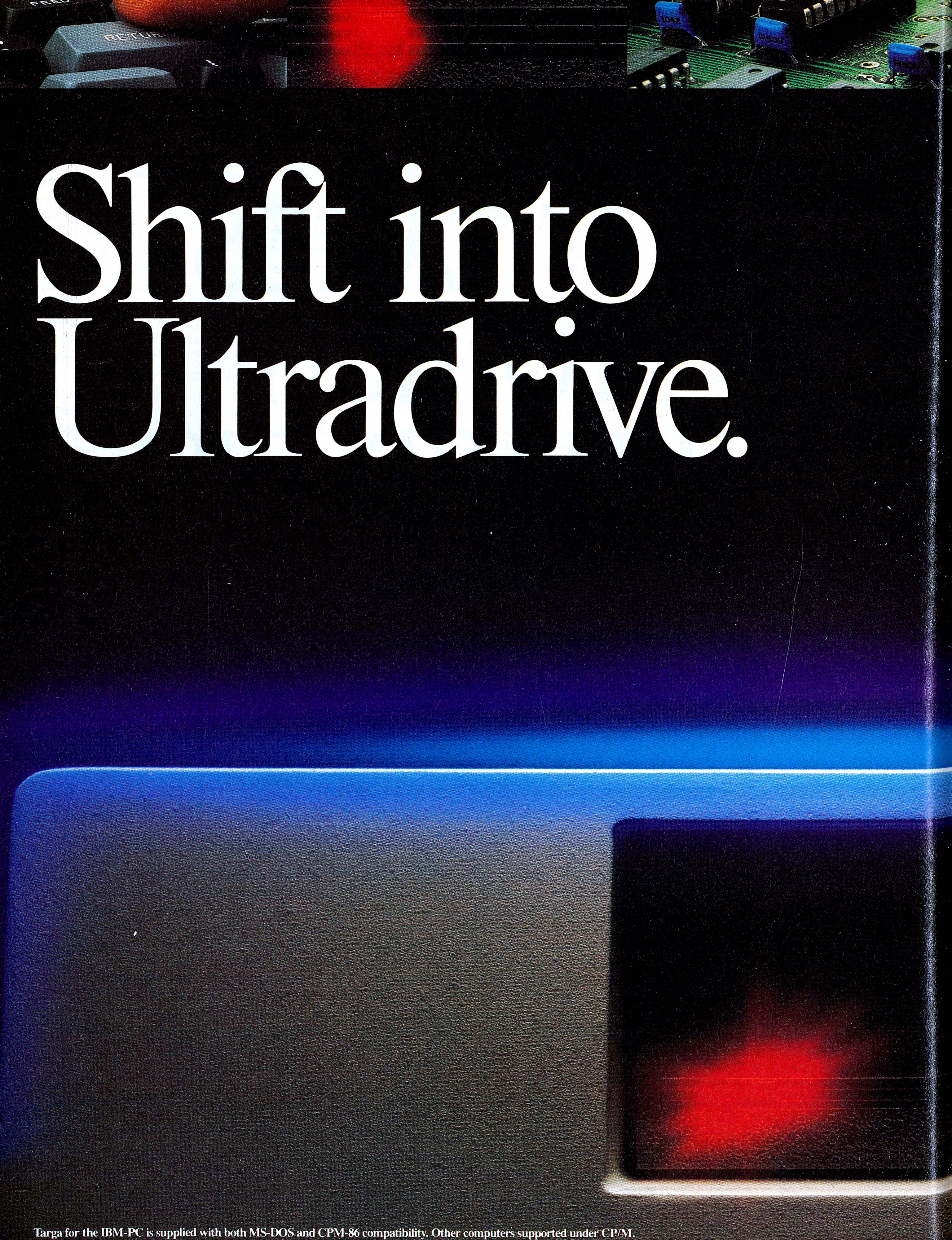

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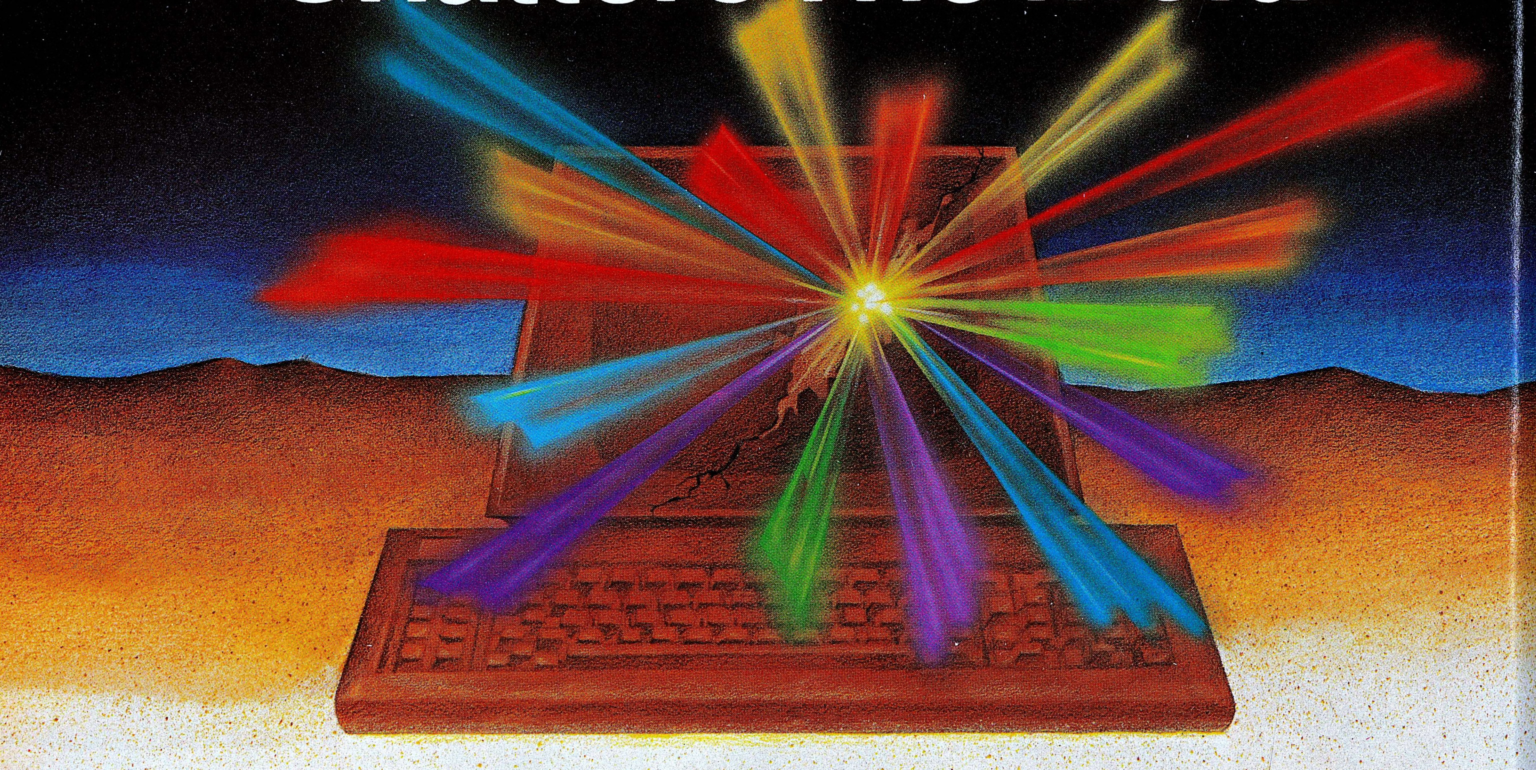

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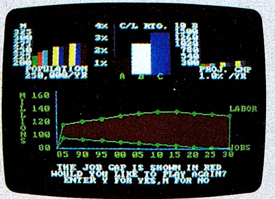
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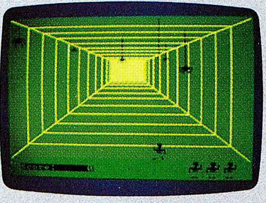

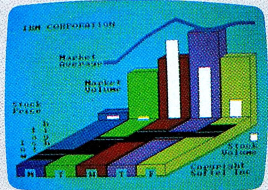
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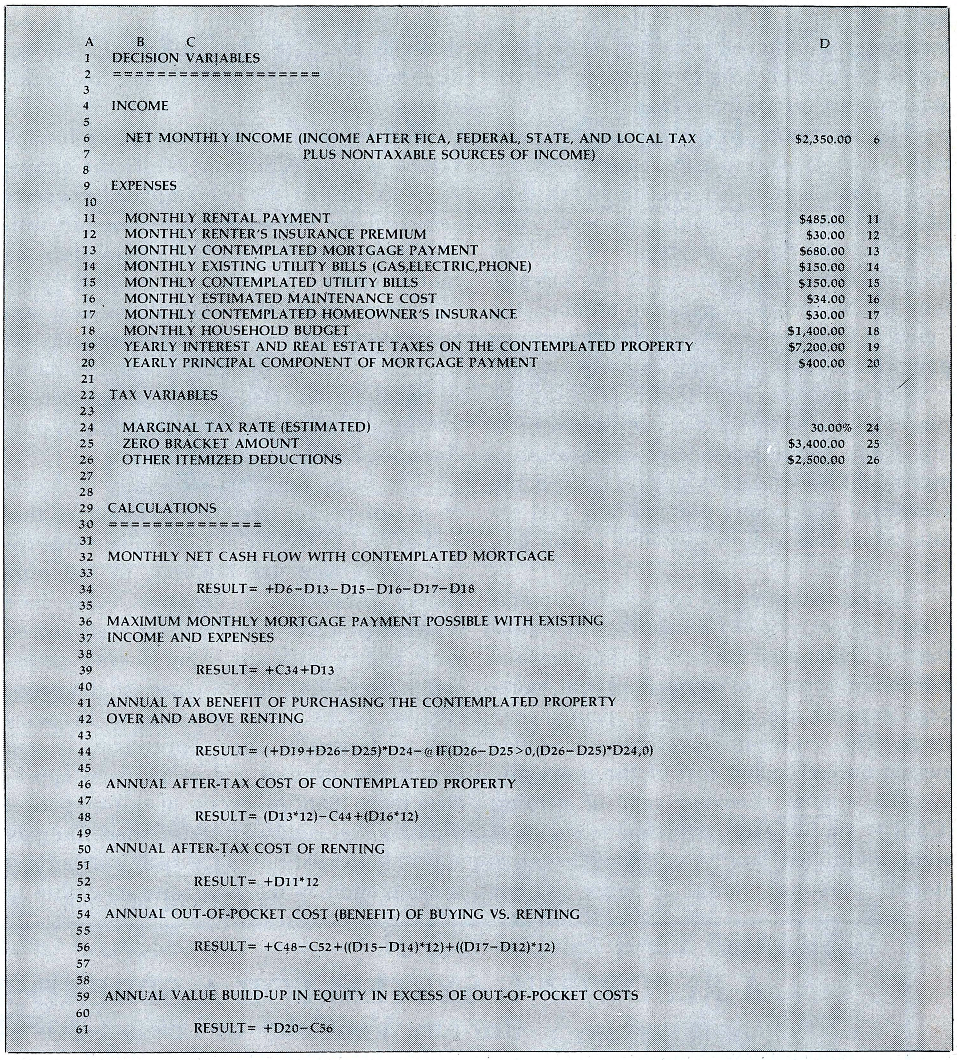

```
A   B      C                                                                          D
1   DECISION VARIABLES
2   ===================
3
4   INCOME
5
6     NET MONTHLY INCOME (INCOME AFTER FICA, FEDERAL, STATE, AND LOCAL TAX          $2,350.00   6
7                            PLUS NONTAXABLE SOURCES OF INCOME)
8
9   EXPENSES
10
11    MONTHLY RENTAL PAYMENT                                                          $485.00  11
12    MONTHLY RENTER'S INSURANCE PREMIUM                                               $30.00  12
13    MONTHLY CONTEMPLATED MORTGAGE PAYMENT                                           $680.00  13
14    MONTHLY EXISTING UTILITY BILLS (GAS,ELECTRIC,PHONE)                             $150.00  14
15    MONTHLY CONTEMPLATED UTILITY BILLS                                              $150.00  15
16    MONTHLY ESTIMATED MAINTENANCE COST                                               $34.00  16
17    MONTHLY CONTEMPLATED HOMEOWNER'S INSURANCE                                       $30.00  17
18    MONTHLY HOUSEHOLD BUDGET                                                      $1,400.00  18
19    YEARLY INTEREST AND REAL ESTATE TAXES ON THE CONTEMPLATED PROPERTY            $7,200.00  19
20    YEARLY PRINCIPAL COMPONENT OF MORTGAGE PAYMENT                                  $400.00  20
21
22  TAX VARIABLES
23
24    MARGINAL TAX RATE (ESTIMATED)                                                    30.00%  24
25    ZERO BRACKET AMOUNT                                                           $3,400.00  25
26    OTHER ITEMIZED DEDUCTIONS                                                     $2,500.00  26
27
28
29  CALCULATIONS
30  ==============
31
32  MONTHLY NET CASH FLOW WITH CONTEMPLATED MORTGAGE
33
34              RESULT= +D6-D13-D15-D16-D17-D18
35
36  MAXIMUM MONTHLY MORTGAGE PAYMENT POSSIBLE WITH EXISTING
37  INCOME AND EXPENSES
38
39              RESULT= +C34+D13
40
41  ANNUAL TAX BENEFIT OF PURCHASING THE CONTEMPLATED PROPERTY
42  OVER AND ABOVE RENTING
43
44              RESULT= (+D19+D26-D25)*D24-@IF(D26-D25>0,(D26-D25)*D24,0)
45
46  ANNUAL AFTER-TAX COST OF CONTEMPLATED PROPERTY
47
48              RESULT= (D13*12)-C44+(D16*12)
49
50  ANNUAL AFTER-TAX COST OF RENTING
51
52              RESULT= +D11*12
53
54  ANNUAL OUT-OF-POCKET COST (BENEFIT) OF BUYING VS. RENTING
55
56              RESULT= +C48-C52+((D15-D14)*12)+((D17-D12)*12)
57
58
59  ANNUAL VALUE BUILD-UP IN EQUITY IN EXCESS OF OUT-OF-POCKET COSTS
60
61              RESULT= +D20-C56
```

$34,000 bracket. The tax for that income level is $6,692 plus 40 percent of the amount in excess of $28,800. So Cory's marginal tax rate is 40 percent.

Presumably, you have an idea how much the property you're considering buying will cost and what your down payment (including closing costs) will be. The difference between the price of the property and your down payment will be the amount you expect to borrow. Once you know this amount, you can get the monthly payment, the total yearly interest, the real estate tax, and the escrow costs from the mortgage lender you plan to use.

You'll need to call your insurance broker for an estimate of what your homeowner's insurance will be. For utility-cost estimates of existing property you can get historical data from the utility companies. If the property is new, you can get estimates from other homeowners with similar homes or from the seller. Make sure the estimates are realistic. If they're not, you may not be eating as often or as much as you'd like, because you'll have to come up with the money somehow.

Now you have collected everything you need from outside sources. From your own records you'll need to estimate your monthly household budget, your net sources of income, and your personal tax information. You'll also need to estimate a new category of expenditure: monthly maintenance on the property.

If you rent, the maintenance of the residence is usually included in your rental payment. Mortgages don't work that way; maintenance is your responsibility. For now, you'll probably have to estimate your maintenance costs; base the estimate on the age and condition of the property.

Your monthly household budget should reflect all your recurring fixed payments, such as car loans, credit card payments, student loans, and so on. For lump-sum payments, such as car insurance, be sure to include the pro-rata portion among your monthly expenses. Your budget should also include such things as food, entertainment, clothing, gasoline, and any other regularly incurred expenditures. To be safe, include a provision for extraordinary expenses—such things as major car repairs or doctor bills. Your budget can be only as good as the amount of time and effort you put into it, so treat it with respect. If your estimates are off, your template could lead you to make a wrong decision.

You can easily get your monthly net income from your paychecks. You'll have to calculate the pro-rata portion of any expected dividends, interest, partnership distributions, or other investments. Take the sum of these and include the figure in your monthly net income variable. Be careful here; many of these forms of income are not received monthly. This means you'll have to be able to supplement your monthly cash flow with savings or borrowings until you receive the cash. If you wish, you can offset these forms of income with the pro-rated expenditures to give you a clear picture of your cash flows versus your expenditures. Be sure your net income variable includes any sources of nontaxable income you receive. Examples of nontaxable income are disability payments, municipal income, and Social Security. These payments, although nontaxable, are available for debt service or other expenses.

Earlier we explained how to determine your marginal tax rate. Your zero bracket amount depends on your filing status. The zero bracket amounts are $2,300 for single, $3,400 for married filing jointly, and $1,700 for either married filing separately or head of household.

Expenditures that normally qualify as itemized deductions include, but are not limited to, medical expenses (subject to limitation), taxes (state income, local income, sales, and personal property), contributions, and interest. For a complete description of qualifying deductions, see Schedule A of federal form 1040, along with accompanying instructions. Please note: This variable is for *other* itemized deductions, so it should not include interest or real estate taxes on the contemplated property. These expenditures are handled differently by the template.

The Calculations. The template uses the information you provide in the decision variable section and calculates key indicators of your ability to afford the contemplated property; it also indicates your potential cost or benefit from buying the property (versus renting). Learning how to read and interpret this template will enable you to make sounder decisions when you consider purchasing.

Net cash flow with the contemplated mortgage (C34) shows you what your available, or *unencumbered*, cash flow is. To arrive at this figure, the template deducts your total expenditures, including your contemplated mortgage payment and the estimated maintenance fund, from your net income. If your template shows a negative net cash flow, it's trying to tell you either to consider a less expensive property or to find a way of reducing your monthly mortgage payment; you may be able to do the latter by increasing your down payment or by finding an alternative form of financing (a variable interest rate loan, perhaps).

The maximum monthly mortgage payment possible with existing expenses (C39) is the sum of your net available cash flow (the previous calculation) plus your contemplated mortgage payment. This item should be self-explanatory; if the calculation at C34 yielded a negative number, the figure at C39 tells you how large a mortgage payment you can apparently afford to make.

The annual tax benefit of purchasing the contemplated property, over and above renting (C44), shows what your after-tax savings might be. These savings result from the additional deductions (interest and real estate taxes) that will be available if you buy the property.

The annual after-tax cost of the contemplated property (C48) is calculated by subtracting the annual tax benefit (the previous calculation) from the sum of annual mortgage expenditure and annual maintenance costs. This number represents the *actual* annual out-of-pocket cost of the property.

The annual after-tax cost of renting (C52) is simply your monthly rental payment multiplied by twelve. As previously stated, personal rental expense is not deductible under current federal tax law. Although some states offer renter credits or deductions, these don't play a major role in this analysis.

Out-of-pocket cost (benefit) of buying versus renting (C56) represents the annual after-tax cost of the contemplated property (adjusted by the expected increase in utilities and insurance), less the annual after-tax rental costs. A positive number here indicates that the out-of-pocket expenditures under the purchase scenario exceed the expenses under the rental scenario. A negative result implies that a cash benefit may be derived from the contemplated purchase.

The value build-up via equity in excess of out-of-pocket costs (C61) assumes that you expect to receive at least equal value for the equity you are building in the purchased property. A negative value here means that your out-of-pocket costs exceed your equity build-up. This doesn't necessarily mean that the purchase of the property would be a bad investment. Property can, and usually does, appreciate. If you expect the value of the property to appreciate more than the excess of out-of-pocket expense over equity build-up, then you may still be better off buying. Another important consideration is the nonmonetary value to you of owning your own home. Many people derive great satisfaction from being homeowners; this is a judgment call that only you can make.

This analysis is static. That is, its implications are valid only for the assumptions used. In essence, it's a snapshot. If you expect a drastic increase or decrease in any of your decision variables, you must run the analysis using a worst-case set of assumptions to make sure you can still afford the contemplated payments and that your purchase decision will be wise even if events turn out less favorably than you hope.

We've purposely not discussed adjusting your withholdings by the estimated tax benefits of your contemplated property purchase. The best way to determine if you should pursue this strategy is to consult a tax professional.

Owning a home can be a rich, rewarding experience, or it can be a financial burden and a source of irritation. Now that you know some of the techniques used to make a buy-versus-rent decision, you're in a better position to understand what your own home could do for you—or to you.

Next month this column will examine *Bottom Line Strategist* by Ashton-Tate. We'll be analyzing a product pricing problem in tutorial review fashion. ▲

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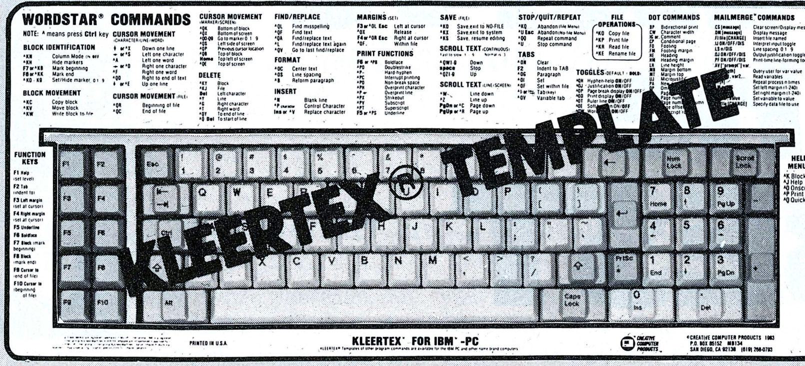

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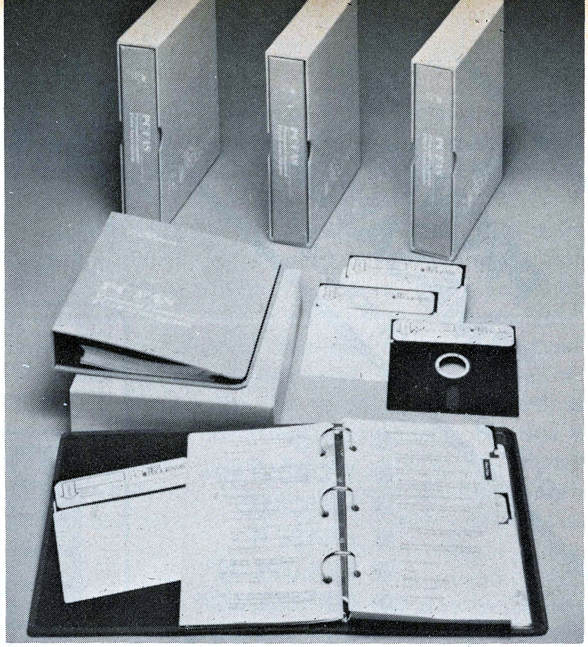

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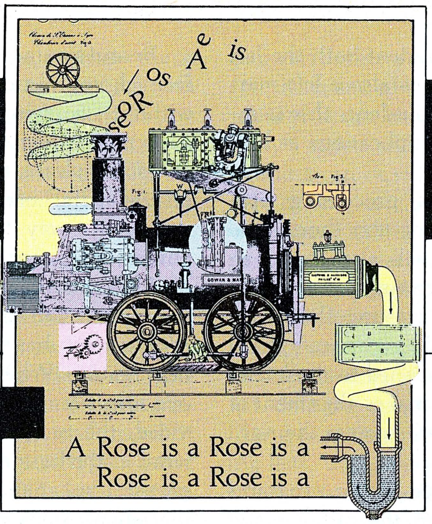
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by F. Lloyd Datz and Terry Tinsley Datz

Wordperfect and Personal Wordperfect

This month we begin our series of reviews with *Wordperfect*, a word processing program from Satellite Software International. We'll also look at its younger brother, *Personal Wordperfect*, a newly released program with many of its sibling's powerful features at a lower price.

What does a small software company in Orem, Utah, know about word processing? Plenty.

Wordperfect was originally written by SSI for Data General's medium and large systems and has recently been adapted to run under PC-DOS on the IBM. Rather than scaling down the Data General program, however, SSI made *Wordperfect* for the pc even more powerful than the mainframe version. In terms of number of features offered, it rivals any of the other word processors currently available for the pc.

This program gives you extraordinary editing, formatting, and document assembly features that allow you to set up columns of numbers and text, define macros, merge mailing-list data, create footnotes, and much more. In addition, an integrated spelling checker and sorting program can be purchased separately.

Overall Design. The editor is command-driven, while the formatter and file manager are controlled by menu. This design makes editing quick and easy, yet provides help with the less frequently used parts of the program. The special function keys and the number keys at the top of the keyboard are used with shift, alt, and control for most of the commands. Since remembering the specific combinations can be a chore sometimes, SSI supplies keyboard overlays to help you keep them straight.

Text Entry and Editing. The editing screen is uncluttered; only a single status line appears at the bottom to display the page, line, and column number of the cursor. This leaves a maximum amount of space for text entry, a refreshing change from most other word processors. When you enter the editor, you are automatically in insert mode; pressing the insert key puts you in typeover.

Wordperfect gives you precise control of cursor movement. The arrow keys move the cursor by character or line and, when combined with escape, move it eight columns or lines at once. To move to the beginning or end of a line, press home and then the appropriate arrow key. Moves to the top and bottom of the screen are similar: Just press home followed by the up or down arrow. Pressing home twice before the up and down arrow will cause the cursor to jump to the beginning or end of the text. Using similar combinations, you can move by word, sentence, or paragraph or jump to the top or bottom of the screen or page. If you edit from printed copy, you'll like having the ability to jump to a specific page number.

The deleting options also emphasize control. The backspace and delete keys erase the character to the left and under the cursor respectively. With two or three keystrokes you can delete by word, by line, to the end of a line, by page, or by block. Deleting text that has been underlined or boldfaced, however, can be a nuisance. You must confirm that you want the special feature itself (the underlining, for example) deleted before text can be erased.

To mark a block of text, press alt-9 and then move the cursor to the end of the text you want to mark. Or, instead of using the arrow keys to position the cursor, you can enter any character and the cursor will move to it. This makes marking a sentence easy: Just enter a period and, presto, the sentence is marked. Similarly, for paragraphs, enter a carriage return and the entire paragraph is automatically marked.

After you've marked a block of text, you aren't limited to moving or copying it. You can also boldface or underline, change lowercase letters to uppercase, save the text to disk, append it to the end of a file, delete it, or print it. If you delete a block by accident, you can reincarnate it, provided that you haven't done any other deletions or moves in the meantime.

Wordperfect will search both forward and backward for strings but will replace in the forward direction only. Unfortunately you aren't given the option of specifying that only whole words be found. The manual suggests that you enter spaces on either side of the word, but this technique won't find occurrences that are followed by punctuation marks.

Since the screen scrolls horizontally up to 250 columns, wide documents are easily handled. There are even special cursor movements and tabs for these oversized pages.

Working with columns is difficult, and most word processors offer little help. *Wordperfect* is an exception. It has a special mode that allows you to move columns. It provides for number alignment by decimal points or commas (decimal tabbing) and allows headings to be centered over each column. There is also a math mode that can add, subtract, multiply, or divide across columns and generate subtotals, totals, and grand totals down columns automatically. As many as twenty-four columns are permitted, and four of these can be used for automatic calculations.

Wordperfect is one of the few word processors capable of aligning several columns of text on each page. It can print up to five columns of text, automatically calculating the left and right margins for each and spacing evenly between them. Try that with *WordStar*.

Another unusual feature of the program is its ability to handle simple business graphics. If your printer can space in half-line increments, with a little practice you'll be able to generate organizational charts and simple bar graphs by combining vertical bars with underscore characters.

Although split screens aren't supported, a handy feature that has recently been added allows you to perform dual document editing by switching between two different files. This means that you can easily move and copy text between documents and make changes in either, since editing isn't limited to the original file.

Formatting and Printing. *Wordperfect* has on-screen text formatting; what you see is almost always what you get. This capability even extends to special print features, such as boldface and underscore, which appear as embedded printing commands on many word processors. One of the few features that aren't shown on-screen is right justification.

Format changes are easily accomplished with the help of a menu that displays all the current settings. Just enter the new values and you're ready to go. Almost all the standard settings can be altered, although the lines-per-inch setting is restricted to 6 or 8. When a document is saved on disk, its format settings are saved along with your text, so you don't have to reenter them each time you call the file back for editing. This spares you the frustration of adding single-spaced text accidentally to a double-spaced document. The program also allows you to make permanent changes to the default settings.

As a help when you're typing outlines and other indented text, *Wordperfect* will set temporary margins that stay in effect until you press the enter key. And to offset sections of text such as quotations, the program will automatically indent both the left and right margins. There is also a left margin release that lets you outdent; this is especially useful for such applications as bibliographies.

Although most word processing programs will center a line of text (horizontal centering), *Wordperfect* will also center an entire page (vertical centering). Also unusual is its capability for creating flush-right text in which each word originates against the right margin and is pushed to the left as you enter it. This feature makes alignment of dates, headers, and footers against the right margin a snap.

Unlike many word processing programs that set miserly limits on the number and length of headers and footers, *Wordperfect* generously lets you define as many as four different multiline headers or footers (two of each) in each document. This allows you to print different headers or footers on odd- and even-numbered pages.

Footnotes are specifically supported and can be up to one page in length. They are automatically numbered as you enter them, and the appropriate amount of space is saved at the bottom of the page. Even if you do extensive editing, each footnote will stay on the same page as its referring text.

Because paragraphs are automatically reformed, you can edit to your heart's content without worrying about reforming each paragraph when you finish it. Veterans of *WordStar* please note: No longer will your printer march off the right edge of the paper on its way to the East Coast because you've forgotten the reform command.

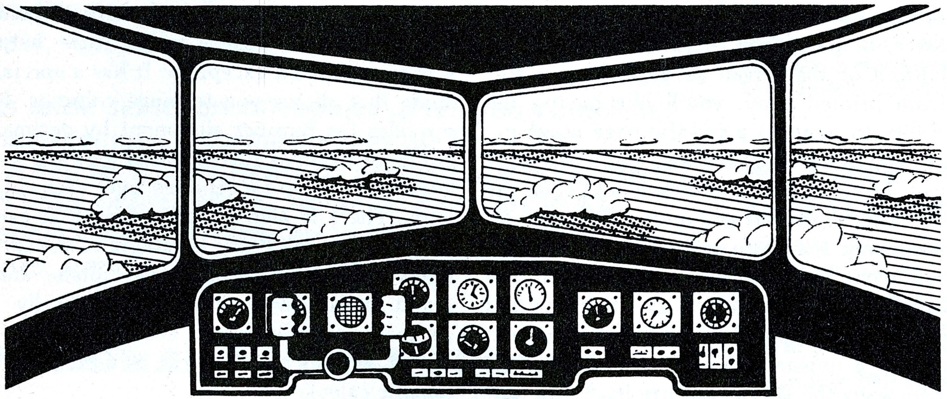
Unlike many word processors that leave the tedious job of hyphenating up to you, *Wordperfect* has an outstanding hyphen-help feature. When a word falling at the end of a line is long enough that it needs to be divided, the program beeps and displays the word at the bottom of the screen with a suggested hyphenation point marked. If that placement isn't what you want, you can move the hyphen to the correct breaking point. You can even change the size of the hot-zone that controls hyphenation. This zone encompasses the few spaces just before and after the right margin setting; any time a word extends beyond this zone, *Wordperfect* prompts you to hyphenate. Making the hot-zone smaller results in more word divisions but creates smoother-appearing text, while a larger hot-zone cuts down on hyphenations but produces more microspaces in the text.

There is one small problem with *Wordperfect*'s hyphenation: If you move the hyphen as far toward the end of the word as the program allows, the word is broken at that point but no hyphen is placed. Therefore, you must remember never to place a hyphen in the extreme right position (a rare occurrence, in reality).

Special printing features, such as boldfacing and underlining, are quickly accessed by means of the special function keys. The position indicator on the status line is either bolded or underlined to remind you that one of these features is in effect. The options for underlining show amazing attention to detail: You can select either single or double underlining and have it be either continuous or broken between words. Subscripts, superscripts, and overprinting (useful for placing accent marks) are also available with the press of a key.

File Handling. *Wordperfect* offers several convenient features for file management. When the file directory is displayed, you can retrieve or delete files just by moving the cursor to the file name; you don't have to type it. In addition, the program allows you to save the file you're working on without leaving the editor. This motivates you to save frequently to avoid disaster in the event of a power failure or equipment failure.

With many programs, a disk-full error means that, unless you can do some fancy file work, you are in imminent danger of losing your document. *Wordperfect* helps pre-



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vent this disaster by showing you how much space your document occupies, along with the amount of space left on the disk. If you still insist on saving a document that's too large, you are allowed to place a new disk in the drive. It would be nice if all programs were this forgiving.

One of the most outstanding features of this program is its ability to handle keyboard macros, blocks of text or format settings that you can call with just a few keystrokes. To define a macro, press alt-6, name it, and type it in. Let's say you define a macro for your return address and name it "ADD." Then every time you type a letter you can press control-6 ADD, and your return address will be entered instantly. Or you can define a macro for a specific format so that each time you start an outline or report, for example, you can call that format. Macros can also be defined as alt and a letter instead of a name. These macros can then be called by pressing alt and the designated letter rather than control-6 plus the name. Although this makes frequently used macros easier to invoke, you may have trouble remembering what each letter represents.

You can even create conditional macros that will do one thing if a condition is true and something else if it's false. For example, you can define a macro that searches a letter for the name of a company. If the name is present it can be changed to a second company's name and the letter printed; if not, printing can be skipped. For real power, several macros can be chained together. With one macro calling a second and so on, you can perform very complex operations with just two keystrokes.

Wordperfect offers superb document assembly capabilities at no extra cost. Form letters can be created and merged with mailing list data by means of the merge feature. There is no required format for these mailing lists; using the editor, you enter each address as a different record, with the name, street address, and city and state as separate fields. You then create a form letter (or any other document, for that matter) and place an F along with the field number wherever you want data to be inserted. The program merges the information into the appropriate blanks and prints the final letter. If you prefer, you can have the information merged on-screen so any needed editing can be done before the print. Data can also be entered from the keyboard during a merge.

Another of *Wordperfect*'s unique features is its ability to handle two printers at a time. If you have both a letter-quality and a dot-matrix printer, you can print with either at will. This spares you the trouble of setting up different copies of the program for each printer you use.

Batch printing is also supported. If you specify which documents to print, which printer to use, and how many copies to make, the program will automatically do the job without supervision. Although background printing (printing while editing another document) is also possible, the editor is slowed down considerably during the printing process (this is also true of most other programs that offer background printing).

Wordperfect Speller. SSI has recently released a spelling checker that integrates with *Wordperfect*. The dictionary contains thirty thousand words divided into two groups. One group contains fifteen hundred commonly used words that are loaded into RAM and checked first by the speller. This arrangement speeds up the proofreading process, since the program must only access the disk when it finds a word that isn't stored in the quick-access dictionary.

The number of words that can be added to the dictionary varies with the storage space available: With double-sided drives you can add about ten thousand words; with a fixed disk the number you can add is vir-

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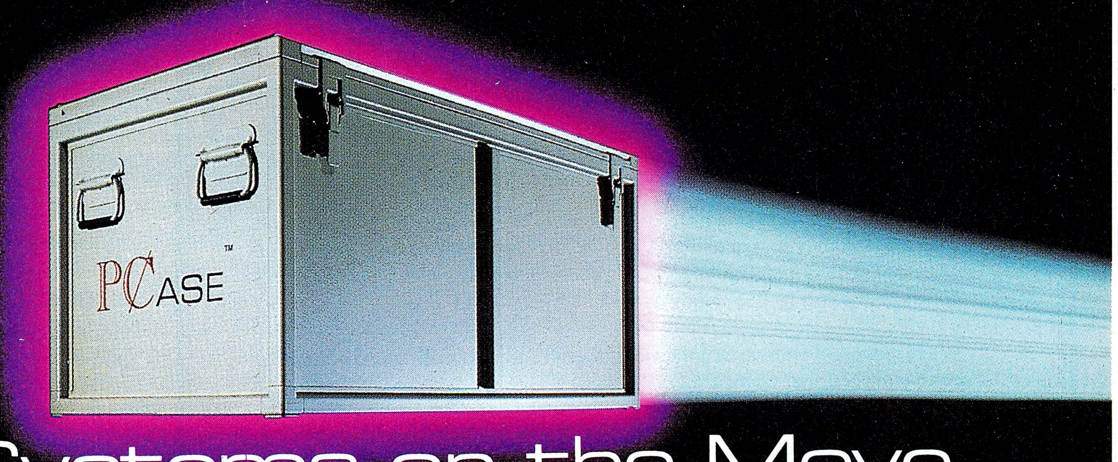

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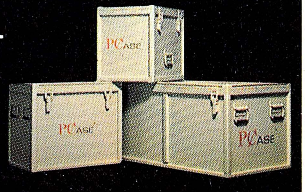

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tually unlimited.

The speller is accessed from within *Wordperfect*. You have the choice of checking a single word, a specified page, or the entire document. The second alternative is nice when you have changed only one page and don't want to wait while the whole manuscript is proofed. Misspelled words are displayed with one line of context, but you have the option of viewing the entire page, if necessary. You can also look up any misspelled words in the program's dictionary. Instead of getting a definitive answer, however, you'll be treated to a listing of all words that start with the first three letters of the word in question.

In addition to looking up the spelling of a word, you can also ignore it, correct it, or add it to the dictionary. When you correct a misspelling, you are given full control of the editor, allowing you to make the changes directly in the text. If you choose to ignore the word, it won't be marked if it occurs again in the same document. The third choice is to add the word to the dictionary. Besides letting you add words to the dictionary one at a time as you run the spell-checker, the program offers a way to add words en masse: Just run one or more documents through the speller, and any words in these documents not already in the dictionary will automatically be added. This would be a handy way to create a specialized dictionary (say, of medical terminology); of course you would have to be certain that the documents from which you created your specialized dictionary contained no misspelled words.

A separate part of the spelling checker allows you to perform dictionary maintenance. Options include inserting or deleting a word from the dictionary, moving a word to the quick-access section, or creating a new dictionary.

Wordperfect Sorter. Just released by SSI, *Wordperfect Sorter* is designed to enhance *Wordperfect*'s merge feature by providing a simple database management system. Records in your data file can be sorted both numerically and alphabetically in ascending or descending order or by key words that you have assigned (you may assign up to fifteen). Relational operators such as < , > , =, *and*, and *or* can be used as well.

The sorter can be used for a number of tasks and is, in fact, sufficient for many database management needs. For example, you can print mailing labels that are presorted by zip code in order to obtain bulk mailing rates. Or you can use it to target specific mailing list entries, such as all female nonsmokers under the age of twenty-five.

To use the program, you create a file of commands, an undertaking that will require some practice, especially since the program isn't menu-driven. Even though several exercises are provided on disk to help you gain experience doing this, you'll still need some knowledge of database systems in order to make use of the program's power.

Ease of Learning and Use. Because the *Wordperfect* editor is command-driven, you may find it takes some time to learn its commands. Because the function and number keys are combined with shift, alt, and control, these commands are somewhat difficult to remember. You may find yourself wondering, for example, whether it's alt or shift that you use with F10 to do footnotes.

Fortunately, the keyboard template provides a handy reminder for these commands. Outside of the editor, the other functions of the program are menu-driven and easy to pick up.

The same attributes that make the editor slow to learn make it a snap to use once you've mastered it. Commands can be quickly entered without the delay of waiting for the appropriate menu to appear. Automatic paragraph reform speeds up the editing process even more.

The built-in help feature is excellent. If you press shift-F3 followed by the key you want help with, an explanation of that key's function appears on screen. Earlier versions of *Wordperfect* included another unique help feature that displayed an alphabetical list of commands, the keystrokes required, and the page numbers explaining them in the manual. Unfortunately, this feature has been dropped from the current version.

There are also built-in safety features, such as messages that require you to give a go-ahead before a document is saved under a previously used file name or before a page or more of text is deleted. The safety devices mentioned earlier that keep you informed about the amount of disk space available are also lifesavers.

Documentation and Support. Earlier versions of *Wordperfect* were plagued with poorly organized documentation. Fortunately this problem has been remedied in the current version; the manual has been rewritten in a more logical format and is now typeset. An index and quick reference card make it easy to go directly to the information that you need. In addition, short exercises are provided in most sections to let you practice what you've just read. Some features (macros, for instance) could benefit from still more details and examples; SSI is currently in the testing phase of a disk-based tutorial that should make learning easier.

Wordperfect isn't copy-protected, and you are encouraged to make backup disks as

3 WAYS TO BUY A WORD PROCESSOR

1. **Casually.** Buy the first program whose name you remember. [After all, they're pretty much the same.]
2. **Carefully.** Study comparison charts and function lists until your eyes glass over and your jaw goes slack--it's called Feature Shock. [After all that, they still look pretty much the same on paper.]
3. **Confidently.** Walk in to a store and ask to try the **Palantir Word Processor** first. Do look at a couple of others, just so you'll feel good about your choice. [After all, what's important in a word processor is how it feels. You'll spend a lot of time using it. You might as well enjoy using it.]

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needed. The phone support is excellent; unlike many of the big guys, the people at SSI seem to enjoy answering questions about their product.

Updates. SSI offers minor updates of the program to registered users for ten dollars and major revisions for thirty dollars; any bug fixes, of course, are free. A soon-to-be-released version will support proportional spacing and a larger character set including foreign characters; it will also allow generic printer interfacing through a fill-in table.

Personal Wordperfect

Don't let the $195 price tag fool you—this is not a watered down, small-fry version of *Wordperfect*. Although some features have been left out, *Wordperfect*'s powerful editor and formatter are essentially unchanged. As a result, *Personal Wordperfect* is one of the most capable word processors available at any price, let alone for $195.

Designed to be simple yet powerful, *Personal Wordperfect* uses the same screens and many of the same commands as its older brother. To make the program easier, however, the number keys aren't used; instead the special function keys control most commands. Otherwise, with the exception of the features listed in the accompanying table the two programs are identical.

Listing the features not present in a program, as the table does, tends to make the program look weak. So keep in mind that even the most popular and powerful of the pc's word processors, *WordStar*, doesn't provide all these features.

System Requirements

Wordperfect and *Personal Wordperfect* both require 128K of RAM and two disk drives or one floppy drive and a hard disk. Text can be displayed on a monochrome or color display. Printers supported include Qume Sprint (5, 9, 11); Diablo (1650, 620, 620); NEC (3510/20, 3515/25, 3550, 5515/25, 7710/20, 7715/25); Epson or IBM Dot-Matrix with Graftrax. Both single- and dual-bin sheet feeders are supported.

Summary

Wordperfect is ideal for heavy-duty word processing. Its powerful features and finely tuned details make it a favorite among those who have used dedicated systems in the past. That's a real compliment to SSI. If you can get by with a few fewer features, at $195, *Personal Wordperfect* is probably the best bargain around.

Wordperfect (version 2.30)	$495
Wordperfect Speller	145
Wordperfect Sorter	95
Wordperfect Personal	195

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Wordperfect Features Missing from Personal Wordperfect

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Centering page top to bottom
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Double underlining
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Left margin release
Left and right indented margins
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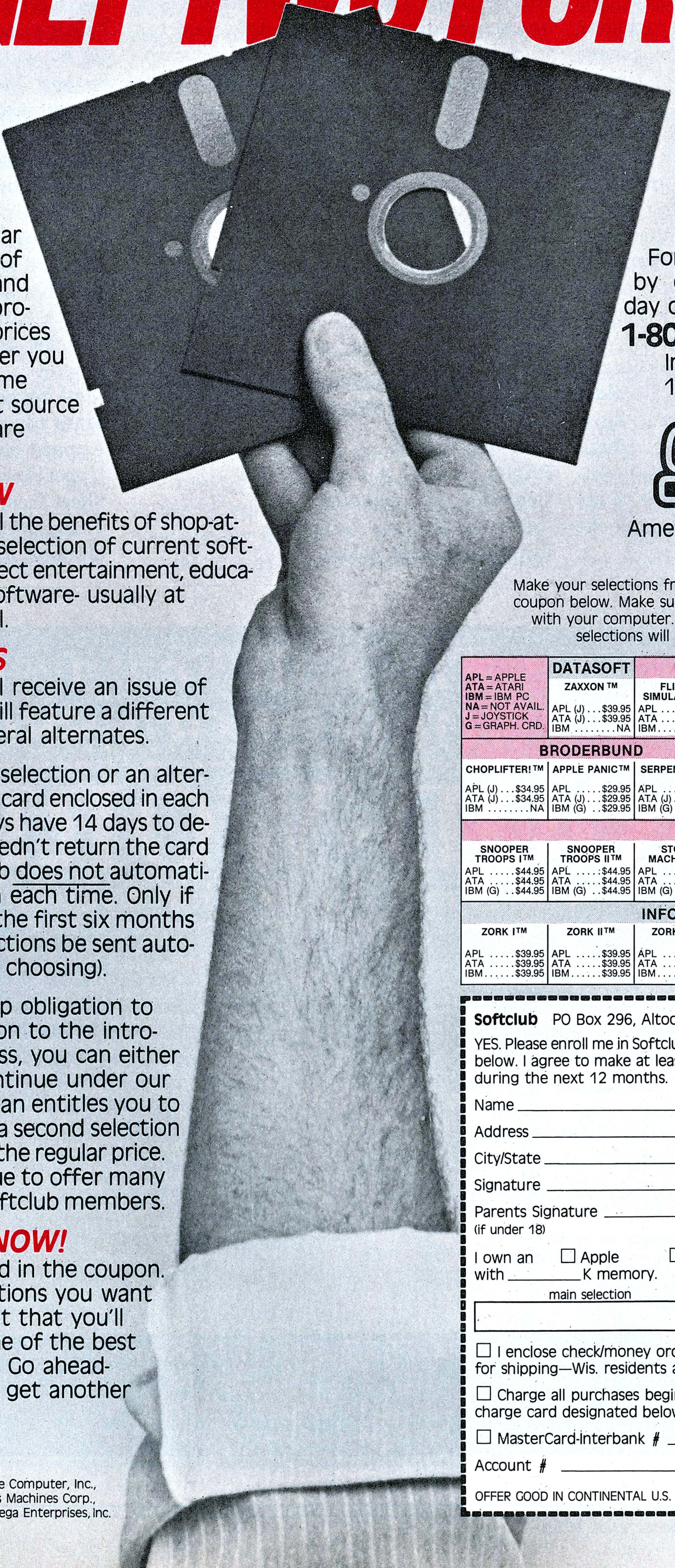

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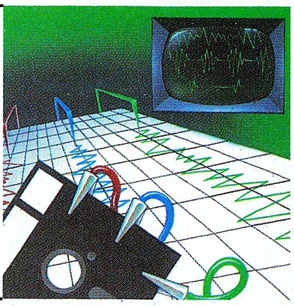


Unless otherwise indicated, software listed runs in DOS 1.1 or 2.0 with either display adapter and requires 64K and at least one disk drive.

The Norton Utilities, Version 2

Peter Norton has brought out his new bag of tricks with version 2 of his popular *Norton Utilities*. They now function under DOS 1.0 to 2.0 with single-sided, double-sided, or hard disk, and there are a few new utilities in the package. The twenty programs on three disks focus on disk inspection, modification, and file recovery.

Those who have used previous editions of *The Norton Utilities* will find a few important changes. Version 2 can accommodate the subdirectories of DOS 2.0 and volume ID labels of DOS 2.0. Hard-disk utilities are added to equal those of the floppies, and a *bload* utility has been included to convert object programs into the Basic *bload* format. The utilities are more compact than early versions, and all are compatible with the *Jel/JFormat* modification that packs extra sectors on a disk.

Newcomers will find *DiskLook* to be one of the trio of gems that crown the set. Menu-driven and controlled by the function keys, *Disklook* can draw a map of the disk, showing the location of the boot and directory, hidden files, locked-out sectors, space allocated to files, and unused disk space, as well as the location of any file's sectors. The contents of any file or sector may be shown in either text mode or in a combined presentation with hexadecimal on the left and the ASCII equivalent on the right of the screen. Information from the display may be sent to the printer via the print-screen key.

Secmod is the companion to *DiskLook*. It not only displays file and sector data but allows you to alter sectors and write them back to disk. It can be used to modify, repair, or patch files, the boot record, the file allocation table, or the directory.

UnErase completes the Norton trio of major programs. Its purposes are to recover erased files on a disk, repair damaged directory entries, and build new files.

The hard-disk equivalents of these utilities are *HardLook*, *HardMod*, and *Hard UnErase*. They require DOS 2.0 and operate essentially the same as their floppy disk counterparts. All three will operate on floppies as well as the hard disk, but they require more memory and have additional commands for use on Winchesters.

The Norton Utilities contains a healthy handful of smaller programs designed to add power to PC-DOS and ease operation of the computer. All are clearly documented.

The menu format of the major utilities together with their prompts makes *The Norton Utilities* as simple to use as they are effective. All of the utilities have thorough error-trapping routines, so it's tough to screw up with any of the programs.

This is the most valuable set of tools anyone will find to inspect, modify, or repair files. The utilities are as simple, reliable, and easy to use as a screwdriver—and as necessary in anybody's pc toolkit.

DR

The Norton Utilities, by Peter Norton (2210 Wilshire Boulevard, Santa Monica, CA 90403; 213-399-3948). $80.

Night Mission Pinball

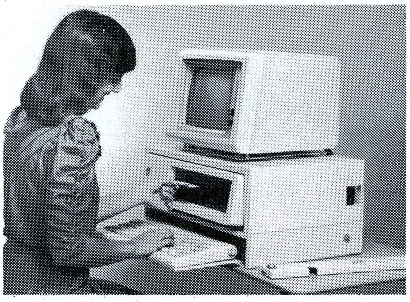
Bruce Artwick, the author of the superb *Microsoft Flight Simulator*, has now released a new creation, under the label of his own company, SubLogic.

The game is *Night Mission Pinball* and the verdict is fantastic. For those of you who thought pinball's days were over, this game proves that the arcade version was just a humble beginning.

Not satisfied with an ordinary pinball simulation, Artwick has opened many of the options of the pinball creator to the player. You can choose any of ten modes designed by the author—or you can design your own mode and save it. Actually, you can design as many as ninety modes of your own, plus ten modifications of SubLogic modes, and still have the original ten modes on disk at the same time. A minor irritation: You have to save your custom modes and high scores to a separate disk.

Among the parameters you can set are ball speed, bounce of bumpers or flippers, duration of hold in trap, visibility of ball trails, tilt sensitivity and effect—and just about everything else.

There is an option to close the left lane gate if you choose, and a



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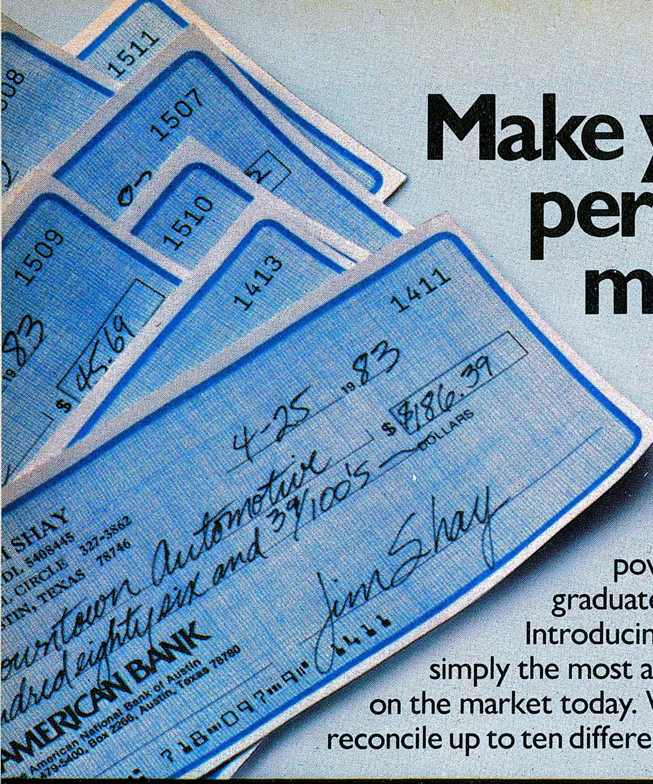
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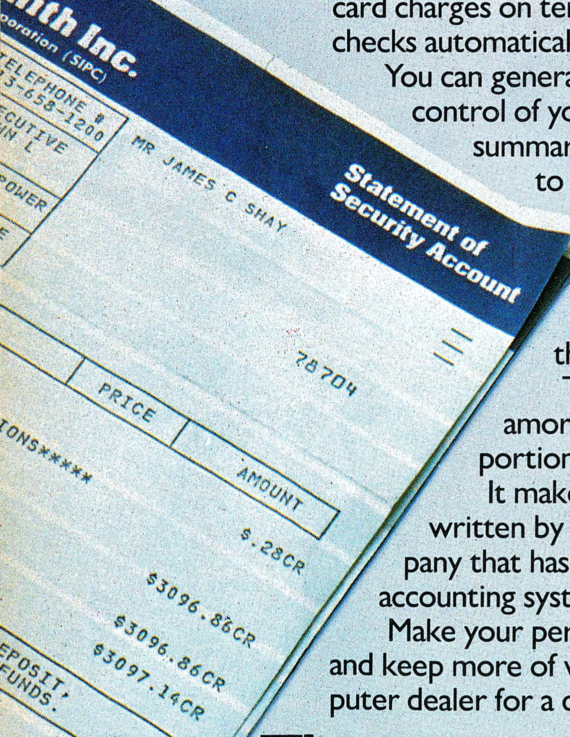
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center post between the flippers can be opened or closed, depending on whether you want the ball to fall out or not. Both options allow you to play a ball literally forever. You can even have a detailed history of the ball's path up to the past five thousand or so x,y coordinates.

All this good stuff really wasn't necessary. *Night Mission Pinball* was good enough the way it was originally designed.

The game has a theme: You are running a night bombing mission over several Pacific island cities during World War II. The sound effects greatly augment the theme, and the pc's sixteen colors, crisp resolution, and speed do superb justice to the game's graphics and animation.

The configuration of features—placement of bumpers, difficulty of dropping through the side, distance between flippers, and so on—is realistic. You even have to insert a quarter to play. Luckily, your keyboard can do this for you. This seemingly unnecessary touch makes winning free games a lot more fun.

Don't miss the cosmic mode. It's just what you've always dreamed of since the day you first thought, "Gee, I wish they'd make a pinball machine where all the balls are slinkies." MCT/MF

Night Mission Pinball, by Bruce Artwick, SubLogic (713 Edgebrook Drive, Champaign, IL 61820; 217-359-8482). $39.95.

The VisiCalc Applications Book

What makes *The VisiCalc Applications Book* so valuable is the care with which the author introduces each spreadsheet application and explains its relevance to specific business needs. The book is a pleasant departure from the simple listing approach taken by so many other *VisiCalc* books. This one assumes the additional responsibility of explaining the limitations as well as advantages of each specific spreadsheet.

The book is designed to let both novice and advanced *VisiCalc* users locate quickly the information they need. Those familiar with *VisiCalc* are urged to read ahead to the application chapters so they can begin immediately building the spreadsheets. Readers new to the program are introduced gradually.

Part I is a hands-on instruction manual for the novice user. The author shows much insight into people's learning needs. The reader is led through a familiar *VisiCalc* application that introduces new commands in a logical order. In the second section of the book the author applies his experience using spreadsheets to six common business problems: credit control, financial statement analysis, forecasting, budgeting, cash management, and portfolio management.

Each spreadsheet is designed using a special packed format; all the required formulas and formats are placed in the model so the user needs only to insert the new row and replicate formulas into place. New users get the benefits of *VisiCalc* quickly, without having to learn the program's entire command structure. This packed format gives the user more flexibility than the standard fill-in-the-blank template. Instead of being constrained to a fixed number of rows and columns, he can grow or shrink the model to suit the application at hand. KE

The VisiCalc Applications Book, by Jack Grushcow, Reston Publishing Company (11480 Sunset Hills Road, Reston, VA 22090). $16.95; with disk, $49.95.

The IBM/PC Guide

Right off the bat, this book has the wrong title. Better it were called *The IBM/PC Basic Guide—A Tutorial*, for that's what it really is. It's also a beginner's book on magic, albeit hard magic. If you're a novice, what Basic can make a computer do is the equivalent of trickery—until you become a magician yourself. And, like any other worthwhile task, this is a hard road. You have to teach youself all the tricks and do your homework, but the results will amaze, from your first *for/next* loop on up to the ultimate word processor, or whatever other application meets your concept of ultimate.

If you're curious about the innards of Basic and have the stick-to-itiveness to learn a foreign tongue, this book will be like Houdini to you. Author Kelley is an engaging instructor with an informative, lucid style. He knows how much he is dishing out and is careful to pace his eleven-chapter course. The information is dense, but a breezy style gets you through it.

In the eleven chapters, which are packed with listings, the author deals step by step with everything you need in order to learn Basic from a cold start. Each chapter covers a specific aspect of programming and what you learn in one chapter applies in the next; you build your knowledge with direct programming applications.

A minor technical flaw in the edition reviewed was that the chapter and page numbers referred to in the IBM reference guides are cued to earlier, unrevised editions. If you keep in mind that the guides are alphabetically arranged, looking things up is a simple task.

A disk of utilities is included free with the book. The disk includes a sketch pad, a file manager, a debugger, and a modeling program—all of which you are encouraged to rip apart and analyze. MF

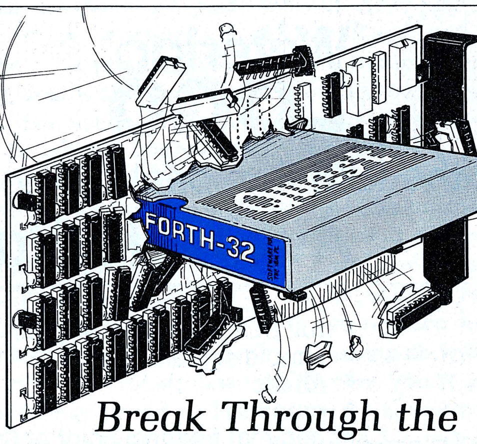
The IBM/PC, by James E. Kelley, Jr., Dell/Banbury Books (37 West Avenue, Wayne, PA 19087). $29.95.

Compac

Compac puts the squeeze on software. It shrinks disk files so that they not only take up less space, but also load more rapidly.

Cutting ASCII-coded files down to size is nothing new, but *Compac* can even compress command files. In one test an object program shed over 6 percent of its space and yet ran the same as it had in its more corpulent form.

Compacted ASCII files shrank as much as 40 percent, but like the kitchen variety they were garbage. Compacted ASCII programs are good for archival purposes, but they can't be read by the program that uses them. A companion utility, *Decompac*, can be called to restore files and programs to their original state. As a pair, the



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programs are useful to shrink the backups and archive copies that you hope you'll never need but don't dare throw away.

Both *Compac* and *Decompac* make friendly prompts for filename inputs, but either will accept filenames as part of the calling sequence of the programs.

With *Compac,* files go on a diet to make the most of disk space. DR

Compac, Sextant Systems (Box 251, Holmdel, NJ 07733; 201-671-7670). $49.

Big Top

Here's another game from Dan Illowsky's Funtastic, and it continues the tradition of quality and playability established by *Master Miner*—clean graphics, simple play options, and rewarding fun.

Big Top is out of a popular bag of arcade goods by way of its ladders and poles. The circus theme of the game is so well thought out you get the feeling you're working the high wire. The higher up you advance, the scarier it gets to play.

You play the part of Wendell the acrobat as he tries to pick up the ringmaster's hats on various screen configurations, called rings. As your bonus points tick down, he's climbing, leaping, ducking—and sometimes conking his noggin—as various balls, bats, and roly-poly clowns come at him.

All this looks incredibly easy as you watch Wendell go through his paces in the demo before you play. Of course, it's not. Unusual for a game of this kind, *Big Top* demands a little thinking. You may try to emulate the strategies of the demonstrating Wendell—good luck.

You'll soon be glad level 1 is so excruciatingly slow. There are nine levels of play—from slow motion to a frantic level 9 that only takes a slip of the joystick to send Wendell plummeting. The 3-to-5 range is quite accommodating.

More than the levels of play, it's the circus "rings" you advance to that are the winning feature of *Big Top.* There are "more than four" says the company—they don't want to say how many more. Levels beyond 3 become rearrangements of previous ones and require different strategies.

Each screen is harder to play and you must master the lower one before Wendell climbs the highest ladder, waves at you, and the next one scrolls down from the top.

You have a choice of using your three chances in the lower screens for points or taking extra Wendells with you to the higher, more fragmented rings. There is only one try for a clean sweep of the ring beyond the first one.

Each ring you advance to presents its own acrobatic surprises. It's like starting all over again each time. And just like working a real circus high wire, if you blow it, it's a long way down. MF

Big Top, by Michael Abrash, Funtastic (5-12 Wilde Avenue, Drexel Hill, PA 19026; 215-622-5716). Requires color/graphics adapter. $39.95.

SurePrint

Trying to use some of the features of a smart printer on the IBM can be a definite pain in the keyboard. For example, to set the skip-over-perforation parameters on the Epson is a multistep task: go to Basic, type in an *lprint* and a litter of *chr$* instructions, and then go back to DOS for a print-screen or whatever.

SurePrint takes the pain out of the printer by creating a multitude of separate files that send each of the printer commands directly from DOS. Another file may be constructed to send the commands from Basic, or a custom file may be built to send a number of printer commands as a batch.

SurePrint fires up with a menu of menus. From the first display, submenus are chosen for character fonts, line spacing, formatting, and the like. Selections are made from each menu for desired features, and a separate 128-byte file is written to disk to command it. For example, the file Comp will set the printer in compressed charactor mode, and the file Xcomp will return to the normal print width.

Separate support packages are required for each printer type. Currently, support files are available for the Epson MX-80, MX-80/Graftrax, and FX-80. Other printers supported include the Okidata, C.Itoh, NEC, Diablo, Texas Instruments, Smith Corona, Anadex, IDS, and Daisywriter.

SurePrint is handy, and it works, but it has its limits. There is no runtime input with *SurePrint,* and if one calls up the file to set horizontal tabs then they will be set to the values established when the file was written. On a many-featured printer like the FX-80, *SurePrint* hungrily gobbles up directory space with its separate file approach; and the more complex features like dot graphics aren't supported by *SurePrint.* From Basic, the utility offers a great deal of flexibility, since the various printer commands can be scattered throughout your program; but from DOS, *SurePrint* is a one-shot program.

But until something better comes along, *SurePrint* is the most helpful program on the market to control a smart printer. DR

SurePrint, by Dickinson Associates (Box 1358, Melville, NY 11747; 516-427-2366). $35.

Master Miner

Dan Illowsky is coauthor of *Snack Attack* from Datamost, an extremely popular Apple arcade game. He left the Apple world a while back to start up Funtastic and design games solely for the pc. The Apple's loss is certainly our gain. *Miner* is a winner.

Games as playable as this one are hard to come by in the Big Blue universe. The rules are simple, learning the game is a cinch, and getting good at it is a challenge that means more than just fun. In short, the game has everything needed for great home-arcade playing.

For starters, the graphics are bold and juicy, big chunks of animated color that really fill out the concept of the game. A two-player mode, where you can play against another live opponent,

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really shows off the game's best features and can be fierce to play. There are five levels of difficulty.

You are given three ships per game and the object is to leave your home base in the corner and pick up gems off the screen, scattered throughout asteroids. You can take only one back to the base at a time; each one is worth 150 points.

Three types of enemy ships pop out of their own base and patrol the game's playing grid. Each alien has a particular pattern it runs, giving it a distinct playing personality. One is more dangerous than the others, and worth more points because he can pick up gems and dance them away from you.

Of course, all this would be merely space mining drudgery if it weren't for the bullets, and there are lots of them. All three alien ships shoot constantly, and you can too. You can even blast down streams of their bullets.

One of the beauties of *Master Miner* is that you are as powerful as your adversaries, the only difference being that there are more of them. However, you have only a certain amount of ammunition to use before you must rest to reload, which can wipe you out in the higher levels.

There are some generic similarities in this game to that great Broderbund arcader, *Serpentine. Master Miner* also affords many small ways to hole up and dodge the enemy while you wait in ambush to rack up points. Tiresome, maybe, but it's another way to play the game.

Taking more chances on your runs for the gems and trying to outsmart the alien ships' quirky patterns is rewarding in its own way and makes the thrill of the hunt last longer each time out. MF

Master Miner, by Dan Illowsky, Funtastic (5-12 Wilde Avenue, Drexel Hill, PA 19026; 215-622-5716). Requires color/graphics adapter. $39.95.

StretchCalc

One of the potential frustrations facing the software buyer is the fact that even the best products tend to quickly become second, third, or nth best. A few classics, like *VisiCalc* or *WordStar*, may hang on to their top spots for a couple of years or more, but maintaining that exalted status is like staying alive in round 50 of an arcade game: With everybody gunning at you you're bound to fall sooner or later.

Pity the poor manager who has a large investment in *VisiCalc* applications. Certainly it would be nice to have all the database and graphing functions that *1-2-3* offers (not to mention *1-2-3*'s facility for automating keystroke patterns), but does he really want to buy new programs, retrain personnel (himself included) and translate existing applications? Even though Lotus did a very nice job of making the transition to *1-2-3* easy for *VisiCalc* users (by making the command language similar in style and by providing translation utilities), the prospect of converting say a dozen operators and a hundred models could appear pretty overwhelming.

Obviously what this person needs is a more powerful *VisiCalc*. Such a product does exist; it's called *VisiCalc Advanced Version*. Apple III and Apple IIe users have been enjoying it for some time, but there's no hard information about when—or if—we'll get it on the pc.

Advanced Version is not *1-2-3*. It doesn't offer any graphing or database capabilities. It has some features that *1-2-3* doesn't, however, such as the ability to base decisions on the presence or absence of specified labels in specified cells. And it's an enormous enhancement of regular *VisiCalc*.

But what does all that matter if we never get it? Do you want to trade in your pcs for a fleet of Apple IIIs?

Help is on the way. A very practical and inexpensive way to beef up *VisiCalc* is here in the form of a utility called *StretchCalc*.

StretchCalc is a front-end for *VisiCalc*. That is, it works differently from the myriad of *VisiCalc* utilities that flourished in the Apple market a couple of years ago. Those programs generally did their work on *VisiCalc* worksheets *after* you had finished them and saved them on disk as text files. *StretchCalc* gets loaded before *VisiCalc* and cohabits memory with *VisiCalc*.

If you copy an exe file from the *StretchCalc* distribution disk onto your *VisiCalc* disk and make a small modification to your *VisiCalc* autoexec file, then the *Visi-Stretch* combination boots automatically. The screen display at that point looks exactly like normal *VisiCalc*, except that the available memory indicator is diminished by 59K (that's the real price of this utility, incidentally; you'll probably want to have at least 192K onboard, even though you *can* run with 128K).

When you hit slash for your first *VisiCalc* command, you get a Multisoft copyright notice on the status line, along with the familiar *VisiCalc* minimenu. But there are two more options on the menu: /A and /U. Most of the features contributed by *StretchCalc* branch off the /A trunk; others that *you* develop, by means of *StretchCalc*, are accessed via /U. But we're getting ahead of the story.

StretchCalc provides three forms of enhancement to *VisiCalc*: It enables you to create eight kinds of graphs from your data and to print those graphs; it allows you to sort and otherwise rearrange your data; and it offers a keystroke macro facility.

To take advantage of the graphing routines, you need a color/graphics adapter (or a Compaq). For the benefit of those who're driving noncolor monitors with their graphics cards, *StretchCalc*'s graphing routines offer a monochrome option that distinguishes different portions of a graph (different areas of an area chart, for example) by shading instead of by color. If you have a color monitor, of course, you can get your graphs in the usual medium-resolution palettes.

The eight available graph types are area, bar, component (stacked) bar, dot, line, high/low/close, pie, and scatter. The pie graph includes an option to explode one slice. After you've put any of these graphs on the screen, you can type P and send it to your printer. Options for printing include reverse (white image on black background), double size (the program truncates on the right whatever it can't fit on your eighty-column printer) and sideways; these options can be selected singly or in combination.

Because *StretchCalc* isn't a standalone graphing program, it's not the most flexible facility on the market. Among its constraints: data sets graphed together must be in adjacent rows or columns; labels for the y and x axes must be in column 1 and row 1 respectively; the title for a graph must be stored in cell A1; you can't apply any movable titles to your graphs. Still, if you've been living with *VisiCalc*'s primitive asterisk bar graphs or making do with separate programs that graph *VisiCalc* data via DIF files, you're apt to find even this somewhat limited on-line service a real improvement.

The requirement that labels and titles appear in column A and row 1 is less of a constraint than it might at first appear; *StretchCalc*'s second major functional area makes it easy at least to get the appropriate material into column A.

The "move" branch of the /A trunk offers two major options: "rearrangement" of columns and sorting of rows. The first of these allows you to take any group of adjacent columns and move them to the left of the worksheet. The sorting option allows you to specify one column as a sort criterion and order any number of adjacent rows according to the values found in that column. The criterion column may contain either values or labels (but not both), and the sort may be ordered in either ascending or descending order.

Sorts and rearrangements may be either temporary or permanent. The temporary kind allow you to take a look at material in a remote section of your worksheet without having to move your cursor; once you've looked you can send it back to from whence it came. If you choose to restructure your worksheet permanently, then *StretchCalc* updates all formula references.

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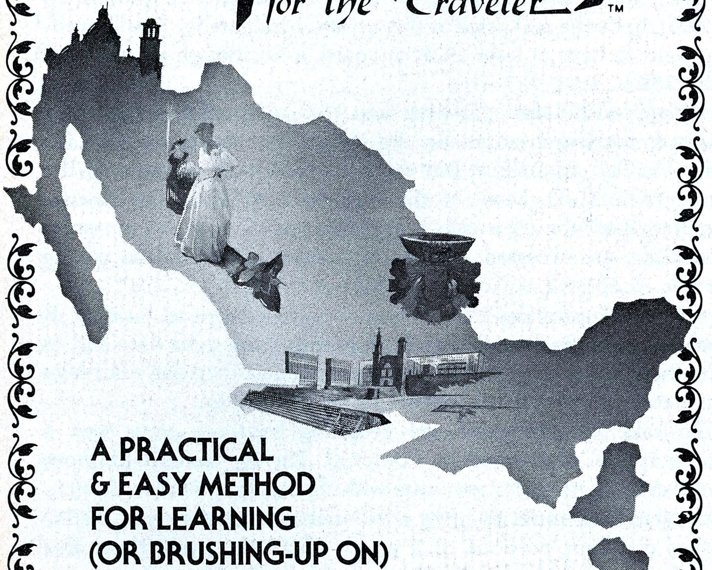

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The third major branch of *StretchCalc* allows you to program an apparently unlimited number of keystrokes into any of the forty function-key characters or the twenty-six alphabetic keys. Once you've put a macro into a function key you can call it up simply by striking the key; for alphabetic-key macros you have to type /U (for user) first.

Unfortunately, *StretchCalc*'s macros don't allow for user interaction (as, for example, *1-2-3*'s do), so you can't use them to set up a turnkey data-entry operation for the complete novice. But you can do some convenient things with them. As an indication of what's possible, the *StretchCalc* disk supplies you with macros to transfer cursor control to the function keys (freeing the number pad for data entry) as well as some commonly needed printer setup strings.

The designers of *StretchCalc* have done a dandy job of making their program cooperate unobtrusively with *VisiCalc*. The *StretchCalc* menus and submenus are displayed on the *VisiCalc* status line exactly like the ones you already know and love (*StretchCalc* even keeps track of what keys have macros stored in them and displays these as options on the status line when you type /U or enter a macro editing command). When you define a range for the purpose of graphing or sorting, the procedure looks and feels just like a *VisiCalc* replication command; you can either name coordinates explicitly or point to them with the cursor—and so on.

StretchCalc is not *1-2-3*. It doesn't have any data-querying functions. It doesn't sort with *1-2-3*'s astonishing speed. It offers no new calculation or report formatting capability. What it does do—for $99—is add a respectable amount of power to *VisiCalc*, without making you learn many new tricks and without making you unlearn a thing. CS

StretchCalc. Multisoft (14025 S.W. Farmington Road, Beaverton, OR 97005; 503-626-4727). Requires 128K and *VisiCalc*. Requires color/graphics adapter for graphing. $99.

1Dir

1Dir serves as a friendly interlocutor between the IBM operator and the sometimes cryptic Disk Operating System. Especially helpful to initiates to the computer community, *1Dir* uses a "pointee-talkee" approach to call the most used DOS functions: point to a file with the directory cursor, point to an instruction with the command cursor, and press the button. Painless.

The *1Dir* display shows a column of fifteen sorted directory entries on the left of the screen, with the selected file indicated by a vertical cursor. The directory cursor is controlled from the numeric keypad with the up and down arrow keys and uses the page up and page down, home and end keys for short-cuts.

The center of the screen shows the date and time and holds statistics of the disk and computer. Given are the number of files on the disk and the number of bytes used, left and total for both the disk and the computer.

On the right of the screen is shown the current state of the toggle keys; caps lock, num lock, and printer echo. Here too are shown the logged drive and the drive whose directory is being displayed.

Across the bottom of the screen are the *1Dir* commands for common functions, such as *erase*, *rename*, *type*, *copy*, *run*, *date*, and *time*. The *compose* command permits entry of a command line for batch processing, and the *execute* command sends it to DOS. The command cursor is moved with the left and right arrow keys, and anything that requires more than a keypress brings up a clear prompt message.

1Dir works with both DOS 1.1 and 2.0 and can be used with volume IDs to slither through the maze of subdirectories to find any program on the disk.

Typically called through an autoexec batch file, *1Dir* remains in control, and when a program or command is completed the pc will return to the *1Dir* display. DR

1Dir, by Bourbaki (Box 2867, Boise, ID 83701; 208-342-5849). $85. ▲

PC IN THE UK

No Little Tramp, no user groups, one pc magazine: The British are doing it their own way

by JoAnn Levy

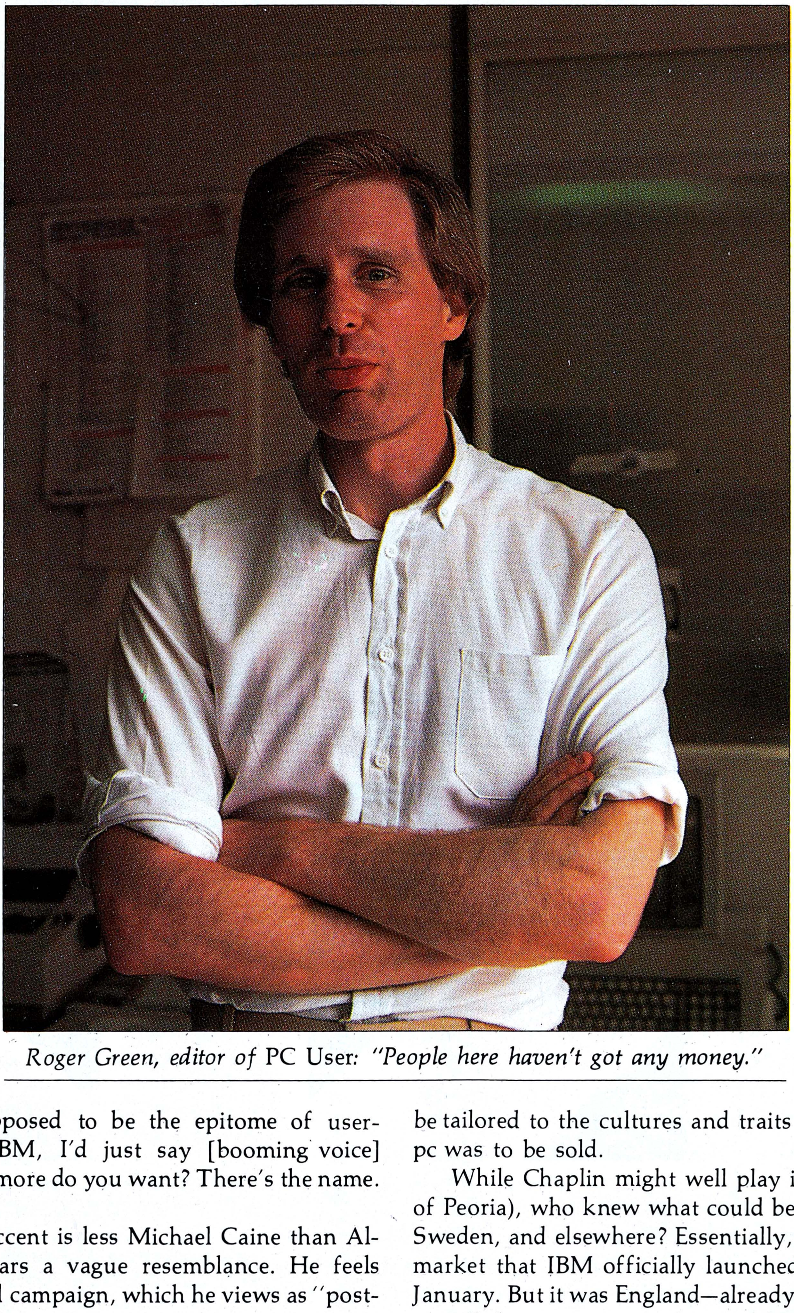
Throughout London's West End, the IBM logo was notably absent from the marquees, but a premiere is in the offing nonetheless. If you can't go to London to see the Queen, going to see the pc is not unlike catching the opening of a new play. The producers have the proper measure of confidence; the audience doesn't seem quite sure what to think of it yet; prop suppliers seem confused, because this production and its U.S. counterpart seem to be playing to different audiences. Almost everyone thinks the ticket's a bit pricy. And then there are the little things that disconcert: The famous three-letter IBM marquee above a Victoria Street address, where the pc is playing, is green. And the larger surprise: Charlie Chaplin isn't the leading man in London. Somehow, one imagines the exasperated little figure left dockside in the States as shiploads of his favorite microcomputer sail over the horizon.

The real difference between the pc in the U.K.

It should be some consolation to the Little Tramp that his replacements are neither tall nor elegant. Indeed, central casting has delivered an international lineup of characters, not one of whom approaches the Tramp's inimitable style.

IBM are (the English, my dears, view collective nouns as the plurals they represent; spend two weeks with them and try to say "The family is leaving" without feeling bloody illiterate). Again—IBM are running full-page "adverts" in London's *Daily Telegraph*; one is a grand old dame wearing a big hat and clunky beads and looking like a cross between Raggedy Ann and a charwoman, with a face that should be selling biscuits to public school first-formers. And that's the message: friendliness.

Mr. Double C Remains Behind. "This is the European equivalent of Mr. Double C," explains Roger Harvey, a London distributor of memory boards for the pc. "We get this sort of weird noncartoon-cartoon character, which is supposed to be the epitome of user-friendliness. But if I were IBM, I'd just say [booming voice] 'IBM Microcomputers.' What more do you want? There's the name. There it is. Buy it."



Roger Green, editor of PC User: "People here haven't got any money."

Harvey's distinct British accent is less Michael Caine than Albert Finney, to whom he bears a vague resemblance. He feels strongly about the European ad campaign, which he views as "post-Impression rubbish."

"People who buy microcomputers are not art experts necessarily," Harvey contends. "There's no style in that ad, because it's not an image that anybody can identify with; it doesn't relate to anything specific. It's a combination of rag doll, Snoopy, cartoon, who-knows-what."

Harvey is the London representative of Qubie', a mail-order distributor of memory boards, Key Tronics keyboards, and some software (*SuperCalc*, *SuperWriter*, and *dBase II*). His business started last February, just a month after IBM's official launch of the pc in the U.K., in a nice little up-market office with good lighting and thick carpeting—a contrast with its Clapham Junction (wrong-side-of-the-tracks) location. While he admits he hasn't cut a hundred invoices yet, Harvey considers his business booming.

Harvey's not the only one with an opinion on IBM's decision to leave the Little Tramp behind. Roger Green, editor of the magazine *PC User*, has a different perspective.

"The Chaplin character was a bit of a millstone. There's quite a bit of logic in not associating your project too much with one image."

In a recent issue of *PC User*, IBM's Personal Computer product manager, John McIntyre, echoed Green's view.

"If you tie yourself too closely to a particular character, you run the risk of the one never going without the other—it's a bit like ham and eggs. If for any reason you have to make a change, then you may actually confuse your public."

One of McIntyre's chief executives in marketing support, Jon Tweddell, suggests that the intent of IBM's switch to a set of characters instead of a single image was flexibility. The new characters were designed as "friendly European cartoons" that could be tailored to the cultures and traits of each country in which the pc was to be sold.

While Chaplin might well play in Penge (England's equivalent of Peoria), who knew what could be expected in France, Germany, Sweden, and elsewhere? Essentially, it was for the entire European market that IBM officially launched the pc in Birmingham on 18 January. But it was England—already doing a land-office business in so-called gray imports—that was keenest for the news.

Rumors had correctly pegged the date for the announcement, but what was not expected was how quickly IBM would set up its dealer network. On launch date, IBM had four of its own retail centers plus seventeen independent dealers signed and trained. Within a week the number increased to twenty-eight, within a month to thirty-seven.

According to Andrew Biddlecombe at IBM's headquarters in Portsmouth, the number of dealers signed by mid-July was an even 100. This is an impressive number for a country small enough to settle in somewhere around the Great Lakes without making too much of a splash.

Being an authorized pc dealer in the U.K., however, requires meeting IBM's two main selection criteria: An applicant must have

...and the pc in the U.S. is in who's using it.

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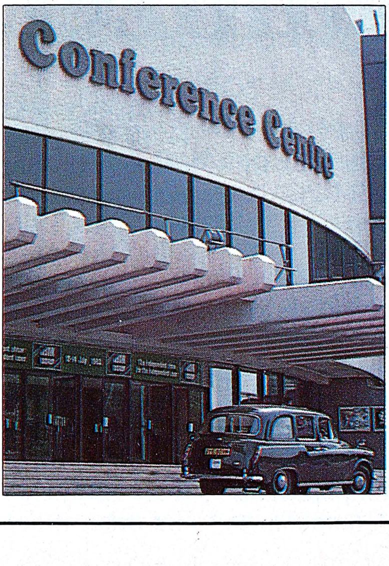
Big Blue keeps a high-profile (above) on a banner facing the Ritz Hotel in London's exclusive St. James area. Wembley Conference Centre (below) was the site of the U.K.'s first-ever IBM user show.

a "suitable retail outlet" and must sell microcomputers of various manufacture. Unable to meet these requirements are the gray importers, who, prior to official availability, supplied an estimated two thousand pcs to Britons eager for hands-on acquaintance.

Gray Imports in the British Isles. The expression "gray import" evolved from a practice that, while not illegal or black-market by any definition, simply had no official U.K. blessing. U.S. machines were imported and fitted with the necessary auxiliary power supply. While some importers allegedly turned to taxi driving after 18 January, some traffic in U.S. machines continued. Bob Woodward of Ferrari Software, a subsidiary of an air-freight firm, said in the March issue of *PC User*, "We're carrying on as normal. A lot of the customers who have been happy to deal with us for the past nine months are happy to stay with us."

The importers were in business as long as they could compete with IBM on price. The collapse of sterling against the dollar, though, eventually hastened the decline of the gray market.

Currently, the European version of the pc (the main differences are keyboard and power supply) is being manufactured in Greenock, Scotland. Initially, only keyboards were assembled at Greenock; the keyboards were then modified as necessary for the various European markets. The U.K. keyboard, for instance, has the pound-sterling symbol above the numeral 3 in the top row. There are eight different European keyboards in all, including three for the Scandinavian countries. There's a routine supplied in the European version of DOS, through which the user specifies the keyboard he has. This is a flexible system that allows the knowledgeable user to access characters in languages other than that for which his own keyboard was designed. With a U.K. keyboard you could, for instance, access umlauts and other special characters. The European PC-DOS also has a new front end that uses the European date style (day-month-year) instead of the American.



The real difference, however, between the pc in the U.K. and the pc in the U.S. is in who's using it—or, perhaps more to the point, who isn't. Most British pc users are corporations rather than individuals. Roger Harvey can attest to that. He sells his multifunction boards primarily to institutional customers. (He suspects that more than a few of them

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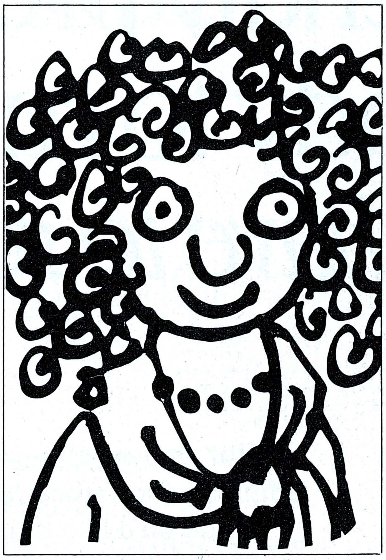
The English simply are not using the pc in the home...

buy sample boards from him, verify that they work as advertised, then order a ton of them from the States.)

Typically the pc is used as a terminal to corporate mainframes. A common configuration for the use of the little machine is in what the British are calling the "information centre."



Ian Chapman, manager of IBM's special business marketing unit, handles direct sales of Personal Computers to large organizations. In a recent issue of *PC User*, he described an information center as "a group of people who are not directly controlling the DP facility." He compared the information center concept to a supermarket; shoppers are given carts and invited to select what they want from the shelves, but they don't need to know much about the organization of the store.

"The concept," Chapman said, "is to try to provide the information that's held in a central database freely to users who don't have data processing skills. Hitherto, that access primarily has been offered on-line."

One company using the pc is Tesco, one of the U.K.'s largest retailers, which implemented the IBM information center concept in the latter part of 1982. Tesco also happens to have what appears to be the only pc-specific user group in Great Britain.

A Lady (and a Gentleman) Replaces the Tramp. These cartoon characters are "the European equivalent of Mr. Double C."

Although *Personal Computer* magazine, a computing news weekly, regularly lists dozens of microcomputer user groups for Apple, Atari, Commodore, Texas Instruments, TRS-80, Sinclair, and others, there is not one group listed for the pc. The English simply are not using the pc in the home to any identifiable degree. Why? "People here haven't got any money," says *PC User*'s Roger Green matter-of-factly.

Of Fat Cats, pcs, and Rolls-Royces. Roger Harvey is even more pointed in his assessment. "One of the most redundant things I've seen produced for the pc are game ports, because nobody in this country is buying pcs to use in their house. They are all in office and business environments. You might have an executive who wants to play *Space Invaders* when his secretary's out, or whatever. In America that's a popular thing, isn't it? I mean a lot of pcs are in people's homes. Here they only go to fat cats. Only two of my customers have pcs in their homes, and they both drive Rolls-Royces."

Such limited personal use explains the low profile of the pc at the U.K.'s first-ever IBM user show, held 12-14 July 1983 at London's Wembley Conference Centre; although, to be fair, when the conference program was planned, the pc had not yet been launched.

The conference, aimed at data processing professionals, did include a presentation by a few pc users in business, primarily the blue-chip international accounting firm of Deloitte, Haskins & Sells, which started with Commodores, then switched to the pc as soon as it became available.

The conference had a disappointing attendance all around, due in large part to several days of uncommonly high temperatures, uncomfortable even for mad dogs and Englishmen. Those braving the heat in proper British business attire primarily browsed software and peripheral support for IBM's 3270 terminals and larger computers, although the pc was on display at CPS Data Systems, Ltd., with a demonstration of its Pelican network for the pc and XT.

According to Green, the audience for the pc in the U.K. is not particularly interested in microcomputers. "People here are not hob-

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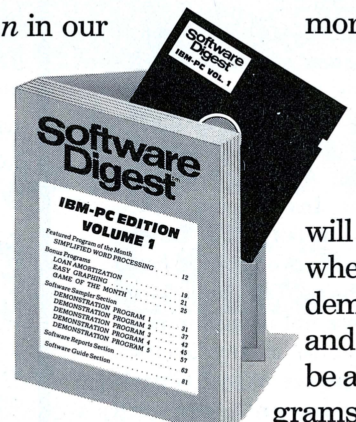
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byists," he says. "They have to use computers in their jobs. They're not interested in *WordStar* or *dBase II*. For those who want a home computer, there is the BBC, a machine designed for the BBC-TV series a couple of years ago that explained how to use computers. It costs a few hundred pounds and is very powerful for most things people would want to use a computer for at home. The pc would have to be one-third or one-fourth the price to make a dent in the home computer market."

Roger Harvey: "Nobody teaches Big Blue about marketing, right?"

And what is the bottom line here? The gray imports, when they were the hot-ticket item, were selling for about thirty-five hundred pounds. Today, from one of the U.K.'s IBM retail centers, a system unit with one drive, 64K, keyboard, and monochrome display costs 2,392 pounds, including value-added tax. In July, the exchange rate between the pound and the dollar was hovering around $1.53 to the pound, which would make the sterling purchase of this minimum machine equivalent to about $3,660. A price list picked up at IBM's retail center at 123 Victoria Street, London, offers the XT for 3,703 pounds, exclusive of VAT. (That VAT is something to be wary of; it can transform two cheeseburgers and a pair of warm lagers into an eighteen-dollar meal.)

The Sirius I (equivalent to the Victor 9000 in the States) holds the number 1 position on the bestseller charts and costs 2,754 pounds, or about $4,215, including VAT. Of course, the exchange rate has not favored the dollar to this degree in many years, so a fair appraisal of the real cost to the British is not reflected in a dollar value. Suffice it to say that, to the man on the street, these two machines are very expensive.

On the bestseller charts, though (rigorously researched by a British market research bureau), the IBM pc has gained the number 2 position for hardware costing more than 1,000 pounds—in a mere six months on the U.K. scene. For the curious: Third place belongs to the Olivetti M20, and fourth to the Apple III. DEC Rainbow is fifth, and the Osborne I sixth. In the chart for microcomputers costing less than a thousand pounds, the top spots are held by Spectrum, Dragon 32, and the BBC B. The Apple IIe, just under the criterion line at 969 pounds, is fifteenth. All these figures are as of 20 July, 1983.

It's hard to tell how many machines are being sold. Speculations about the pc sales rate range from 1,000 to 10,000 per month. IBM, of course, isn't telling.

A Nonofficial Secrets Act. "Here in this country," says Harvey, "if you work for the government, you sign a thing called the Official Secrets Act, which means that if you ever say anything about even the color of the socks on anybody in the department you work for, you can be sent to jail for thirty years without trial. I think they have the same thing at IBM. You never find anybody who's prepared to give even accurate information about the company. It's their prerogative. They're not a government, they're a business organization, and they keep their information to themselves."

Software polls, except for those that track game sales for the smaller machines, appear to hold no interest for the serious pc user, who simply wants to know if a product is available, not whether four out of five dentists recommend it. There is an estimated three-to-six-month delay between U.S. release and U.K. availability, so software supplies are erratic. However, there is more software for the pc, says Green, than for any other sixteen-bit machine, even though the Sirius has been eighteen months building up a software base.

There is also a good deal of local competition here, where being small doesn't matter that much, because the country is small. A small company here can achieve nationwide distribution with only three strategic cities in its network.

Still, U.S. users will recognize most of the software here. IBM retail centers carry the usual stock, plus the new *PeachText* and an anglicized version of *EasyWriter* (not *EasyWriter II*, which is available from other dealers and mail-order houses).

The July issue of *PC User* contains a software directory with more than five hundred "packaged programs now available or about to be available" for the pc. Most of these are U.S. imports, including forty-four games. "I don't know who's buying them," says Green, adding that one chagrined distributor, upon receiving a potluck shipment, said, "What am I going to do with two hundred copies of a game?"

Whether or not *Zork* will ever gain a following here is debatable, but it appears that the pc is here to stay. "We're very pleased with the way things are going," says IBM's Tweddell. And well they should be. IBM has been a presence in the U.K. for more than a quarter century, and the company's contribution to the ailing British economy is such a source of pride that IBM's classified adverts for secretarial help even contain an appended list of the company's own accomplishments. One such recent classified in the *London Standard* cited, among other achievements:

15,000 jobs in over 40 UK locations
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£522 million exports in 1982
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To the right of these modestly stated sources of pride was the familiar three-initial logo. But to the left was another logo—elegant, understated, with a small crown above these words: "By appointment to H.R.H. The Prince of Wales—Suppliers of Typewriters and Word Processing Equipment—IBM United Kingdom Limited, Portsmouth."

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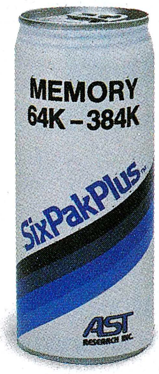
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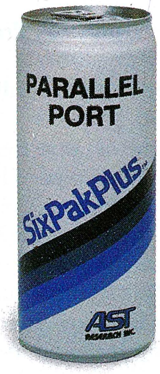
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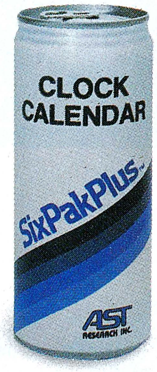
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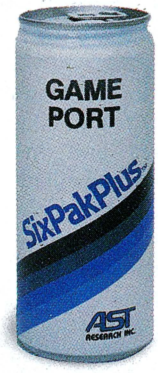
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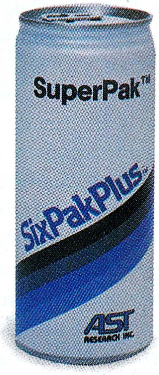
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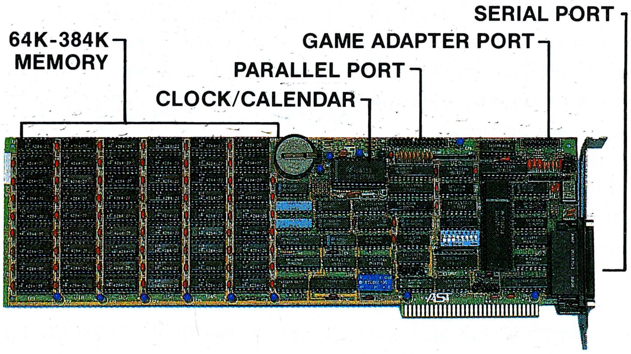
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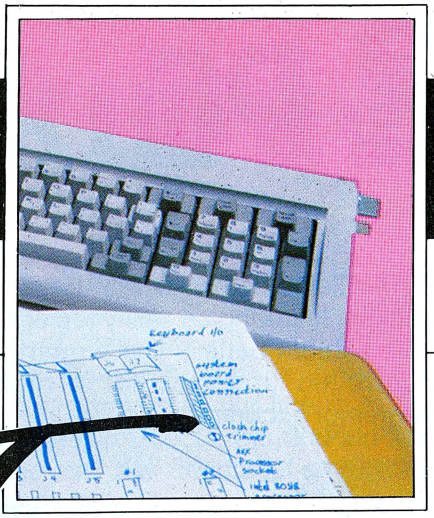

SYSTEM Notebook

by Alan Boyd

An Introduction to Pipes and Filters

This month we finally get to the long-promised topic of *pipes* and *filters*. Like hierarchical file structures and input/output redirection, pipes and filters are features that have been "appropriated" from Bell Labs's Unix operating system. DOS 2.0's implementation of pipes and filters is unique in the realm of microcomputers, having no functional equivalent in either of the two alternate IBM pc operating systems, CP/M-86 or the UCSD p-System. Although to many of you these will be unfamiliar concepts, you'll find it easy to put the powerful capabilities of pipes and filters right to work.

Pipes and filters behave in much the same way as their real-life counterparts in, for example, a plumbing system. Pipes are traditionally used to pass water from one point to another, while filters are used to treat the water that passes through them. In DOS, pipes are used to pass data from one command to another, while filters treat, or modify, the data that passes through.

In the world of microcomputers, a filter is a command that takes data from a specified input, performs some action on the data, and sends the altered data to an output. Filters are really no more than DOS commands that have both an input and output; contrast that with other DOS commands, such as *dir*, that do not require you to specify an input.

A pipe, sometimes called a pipeline, is a mechanism that allows you to join two DOS commands or programs. A pipe performs this feat by automatically directing the output of the first program into the input of the second—it *pipes* one program's output to the input of another. In this way, DOS commands and programs can be strung together to expedite complex tasks.

Let's take a look at a problem that can be solved quite easily using DOS commands in conjunction with pipes and filters.

Suppose we had a file of vendors from which we wished to extract all the vendors in Los Angeles. We would then like to sort the list of Los Angeles-area vendors according to the price they charge, and print the resulting list. Up to now, the only way we could have accomplished this task would have been by writing a program (or programs). Instead of doing that, let's break the problem down into its individual components:

(1) Filter through the file and extract only those vendors in the Los Angeles area.

(2) Take the output of the first step and create a temporary file.

(3) Write a program to sort the temporary file according to item price.

(4) Take the output of the previous step and create a second temporary file. This file would contain a list of Los Angeles-area vendors, sorted by price.

(5) Print the temporary files from the previous step.

This approach can be summarized by the following diagram:

Master File	**Los Angeles** ------->	**Temporary File #1**
Temporary File #1	**Sort by Cost** ------->	**Temporary File #2**
Temporary File #2	**Print** ------->	**The Solution**

The solution to our problem requires three distinct steps, coupled with the creation of two temporary files. If we want to apply the official terminology to our problem, we could say we have filtered the original files, extracting all of the vendors in the L.A. area; piped the results (via temporary file 1) to a second process that filters the data again (the sort by cost) and places the output in temporary file 2; and finally piped the contents of file 2 to a command that sends the data to the printer. If we redrew our diagram on one line, it would look like this:

Master File	---->	**Los Angeles**	---->	**Sort**	---->	**Print**
file	**pipe**	**filter**	**pipe**	**filter**	**pipe**	**filter**

Each of the individual processes can be thought of as a filter, while each of the temporary files can be thought of as a pipe. That suggests a refinement of our definitions for pipes and filters: A pipe is a mechanism that can transfer the output of one process to the input of another; a filter is a process that modifies its input data and sends it to its output. This entire process of sending data through pipes and filters can be accomplished by a single DOS command.

As you might have noticed, pipes and filters are really no more than a natural extension of the I/O redirection capabilities we have been playing with the past few months. When used in conjunction with I/O redirection, pipes and filters present a new and exceedingly powerful way of processing data without ever leaving DOS and without making you resort to a programming language.

Before we get in too deep, let's digress for a moment and lay some groundwork that will help you understand where these new features fit into an operating system, where they came from, and how they are applied.

In the Unix operating system there exists the concept of the *shell*. The shell is the part of the operating system that the user sees and interacts with; it is the interface between the operating system and the user. Unlike PC-DOS, Unix is a multiuser operating system for minicomputers, and it is both more powerful and more complex than DOS. Unix users quickly discover that, in addition to its use as a simple command line interpreter, the shell can be used as a very powerful programming language.

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The structure of DOS is, in many ways, similar to that of Unix. In particular, the unit that we think of as the command line interpreter, or shell, is a separate module stored on disk under the name *Command.com*. The file is read into memory at boot time and is incorporated into DOS. DOS's architecture allows the command line interpreter to be replaced with a customized program that any competent systems programmer could write; in this way, a programmer can create a special shell that shields the user from the operating system. (For a custom shell to work with DOS, it simply needs to process commands the same way that Command.com does.) Thus Command.com can be properly termed a shell, not quite in the same league as the various shells available under Unix, but powerful enough in its own right to be quite useful. Shell programming is accomplished by stringing together groups of DOS commands, with the output of one command piped to the input of another. In this manner DOS commands can be made arbitrarily complex.

When we looked at the function of I/O redirection earlier, the concepts of *standard input* and *standard output* were introduced. Standard input, you may recall, is the device from which input is obtained for a DOS command or program; the default for standard input is the keyboard (Con:). Similarly, standard output is the destination device that receives all output; the default for standard output is the video screen. All devices with which DOS communicates can be treated as if they were files; by changing the source of data, we redirected input to come from a file, rather than the keyboard.

Filter commands are DOS commands that obey this rule: They are written to accept their input from standard input and write their output to standard output. This is conceptually different from standard DOS commands, which specify their input and/or output within the command itself. For example, the *copy* command uses a user-specified file as its input and another user-defined file as its output; the concept of standard input and standard output is not necessary to understand or use the *copy* command. With the *copy* command, at least, things are complicated a bit by the fact that redirection can be used to direct the input or output to standard I/O. Nonetheless, the regular mode of operation does not involve these devices for other than error messages and prompts.

Let's return from our background briefing and look at some examples of filters and pipes. We'll start with a filter command whose purpose is both fairly obvious and very useful, the *sort* filter. *Sort* works by accepting an input stream from standard input, sorting the contents, and writing the sorted information to standard output. Schematically, *sort* works like this:

```
Standard Input------> Filter------> Standard Output
```

While you could use redirection to change the source of standard input and the destination of standard output, for now let's just look at the simpler form of the command.

Slip a copy of DOS version 2.0 into your disk drive and enter the command *sort*. Since the *sort* code is stored on the DOS disk under the filename *Sort.exe*, DOS will load and execute it just as it would any other DOS command or program. Now enter several names, terminating the list with a control-Z (F6). The screen might look something like this:

```
A>sort
piggy
gonzo
scooter
bert
ernie
kermit
^Z

bert
ernie
gonzo
kermit
piggy
scooter
```

The *sort* command has filtered the input coming from standard input (the keyboard), sorted it in alphabetical order, and output it to standard output (the screen). *Sort* sorts on a line-by-line basis, starting at the first column. Where there are two lines that have the same character in the first column, it will continue the sort based on the second character, and so on until the tie is broken. In other words, it sorts much as you would.

But not exactly. *Sort* has two peculiarities that you should know about. First off, *sort* sorts according to the ASCII value of the letters it encounters. Since ASCII is arranged so that B has a higher value than A, and C higher than B, that would seem to be fine. But recall if you will that ASCII differentiates between a lowercase letter and its uppercase version. A lowercase *c*, for example, has the value 99 in the ASCII code, while an uppercase C has the value of

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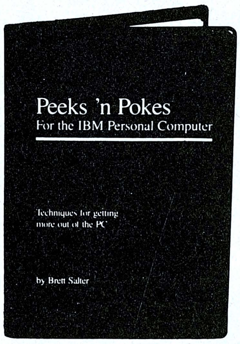

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67. As a matter of fact, the entire uppercase alphabet has lower ASCII values (65 to 90) than the lowercase alphabet (97 to 122). You guessed it: *Sort* will put any item that starts with an uppercase letter before any item that starts with a lowercase letter, never minding that the lowercase word might be aardvark and the uppercase word Zoo. To see for yourself what this means in actual use, type in the following example:

```
A>sort
B
b
A
C
c
a
^Z
```

DOS responds by printing the sorted list:

```
A
B
C
a
b
c
```

That's clearly not the straightforward lexigraphical ordering most people expect in an alphabetically sorted list. But despite its being both counterintuitive and awkward, it is possible to live with: just be sure that the data you are working on has a consistent format. (If you can't guarantee that, you'll have to write your own program to do the sorting, or perhaps just a filter to convert all characters to one case or the other.)

Let's take the example we were working with earlier one step further by writing the results to a disk file. We can do this by redirecting the output to a file, using the symbol for output redirection, >, which we learned in a previous example. Try typing

```
A>sort  >list
piggy
bert
ernie
gonzo
scooter
kermit
^Z

A>
```

When it's done sorting, DOS opens the file named *list* and writes the names into it; read the file by *typing* it to see for yourself.

We could, if we wish, go one step further, and use the input redirection symbol < to direct input to come from a specified file and output to go to another file. Create the input file with

```
A>copy con: names
piggy
bert
ernie
gonzo
scooter
kermit
^Z
      1 File(s) copied
```

Now our command would look like this:

```
A>sort  <names  >list

A>type list
bert
ernie
gonzo
kermit
piggy
scooter
```

Sort is one of three filter command programs shipped with DOS 2.0; the other two are *find* and *more*. Each of these commands has a single simple purpose, a concept in keeping with Unix's overall philosophy of providing tools that perform only one function but perform it as well as possible. Unix gains its power and versatility by letting the user easily and quickly string commands together to perform complex operations.

But let's get back to *find*. *Find* looks for occurrences of specified strings in a file. As an example, let's look for any occurrence of the letter *i* in the file List, which we created in the last example. We could enter the command

```
A>find "i" list
```

and DOS would respond with

```
--------- list
ernie
kermit
piggy

A>
```

As you may have realized by now, the *find* filter is line-oriented—meaning it will find and pass any complete line that contains the string of characters we specify (in our example, the single letter *i*). *Find* has a convenient built-in way for the user to change the source of input: Just type the input filename after the string.

Like any other filter, *find* can be used with standard input and standard output; that's our familiar interactive mode wherein input comes from the keyboard and output goes to the screen. Try it by entering

```
A>find "i"
```

As you then type lines of text at the keyboard, the *find* filter will

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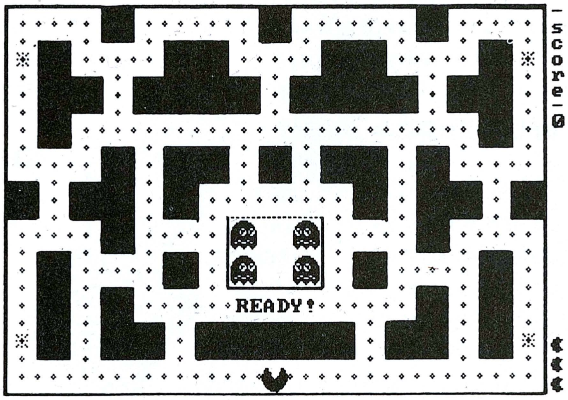

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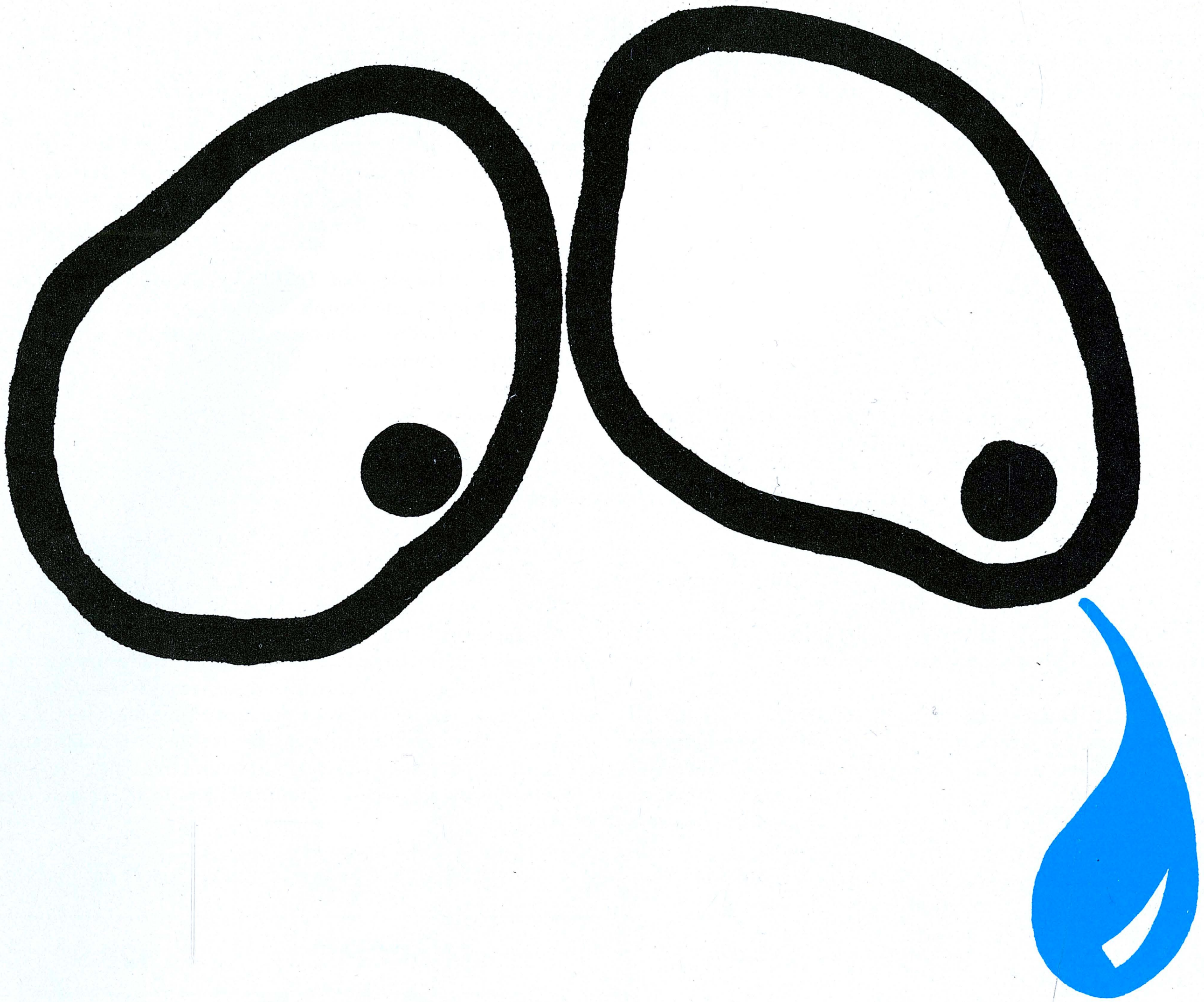

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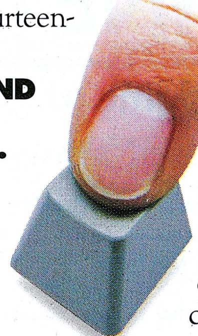

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analyze each line and print those that contain the string *i*. This can be minimally useful when you also redirect the output. If, for example, you wanted each line that contained the letter *i* to be sent to the printer as well as to the screen, you could enter the command

```
A>find "i"   >prn
```

Now each line that you enter that has one or more *i*s in it will be sent to the printer. Alternatively, you could direct the output to a regular file.

The *more* filter command is quite trivial; its function is simply to halt output when the screen becomes filled; *more* prompts for a key to be pressed before it will write the next screenful. This command is particularly nice if you want to look at the contents of a file that takes more than one screen to display.

With the *find* filter, the *sort* filter, pipes, and I/O redirection now in our bag of tricks, we have everything we need to tackle the task we set for ourselves earlier: extracting Los Angeles vendors from a file, sorting them in a particular order, and printing the resulting list. To work out this exercise it will be necessary to enter a short table into a DOS file using the *copy con:* command, or using any text editor capable of generating standard ASCII text files. (A word of warning is in order here. Be extremely careful if you use a word processor; many of them, even *WordStar* in nondocument mode, occasionally insert odd nonprinting characters. If the following examples do not work right, try reentering the list using the *Copy Con:* command.)

The table should be entered exactly as shown, beginning each line in the first column. Note that where there are multiple spaces in the table you should actually enter all of the spaces independently, rather than using the tab key. Terminate each line with a carriage return and terminate the file with a control-Z end-of-file marker. Start the "cost" field at column 40.

```
A>copy con: table
Vendor                        City                 Cost

International Corp.           Los Angeles        123.44
Fortnum International         Chicago            101.99
Druryl Imports                Los Angeles        102.55
Applied Systems               Los Angeles         95.00
Maxwell Smart Widgets         Los Angeles        104.15
Widgets Inc.                  New York           104.15
Allied Widget                 Los Angeles         99.88
Smith Inc.                    San Francisco      101.85
```

Now let's filter the file Table using the *find* command, selecting only those lines that contain the string "Los Angeles." Since *find* normally sends its output to the screen, we will redirect output to a temporary file, Temp1.

```
A>find "Los Angeles" table   >temp1
```

If you verify that this command worked as expected by typing it, you should see

```
A>type temp1
---------- table
International Corp.           Los Angeles        123.44
Druryl Imports                Los Angeles        102.55
Applied Systems               Los Angeles         95.00
Maxwell Smart Widgets         Los Angeles        104.15
Allied Widget                 Los Angeles         99.88
```

The *find* filter has eliminated all of the items in the file that did not contain the string "Los Angeles," exactly as we had planned.

The next step is to take the contents of the temporary file Temp1 and sort it using the *sort* filter. Recall, however, that if we simply run the contents of a file through *sort*, the lines will be sorted by the character string that starts in column 1. In this case, that will generate a list sorted alphabetically by company name:

```
A > sort <temp1 > temp2

A>type temp2


---------- vendor.lst
Allied Widget                 Los Angeles         99.88
Applied Systems               Los Angeles         95.00
Druryl Imports                Los Angeles        102.55
International Corp.           Los Angeles        123.44
Maxwell Smart Widgets         Los Angeles        104.15
```

Exactly what we expected, but not what we wanted; we wish to sort our list based on cost. The trick to doing this is to define the starting column on which *sort* is to begin its analysis. In our example, the cost field for each line starts in either the fortieth or forty-first column, depending on whether the cost is above or below 100. This isn't a problem, since if we start sorting on the fortieth column, a blank space (costs less than 100) will be sorted before a *1* (costs greater than 100), because ASCII assigns a lower value to a space than to a *1*.

Sort includes just the capability we need to specify the starting column—a switch. As you might know, a switch is a field that follows the command, and is preceded by the / character. To specify a starting column of 40 to the *sort* filter, type:

```
A>sort /+40   <temp 1   >temp 2
```

Now look at Temp2:

```
---------- vendor.lst
Applied Systems               Los Angeles         95.00
Allied Widget                 Los Angeles         99.88
Druryl Imports                Los Angeles        102.55
Maxwell Smart Widgets         Los Angeles        104.15
International Corp.           Los Angeles        123.44
```

Now we can send file Temp2 to the printer by *copying* it to Prn:, thus completing the third and last stage of our task. The com-

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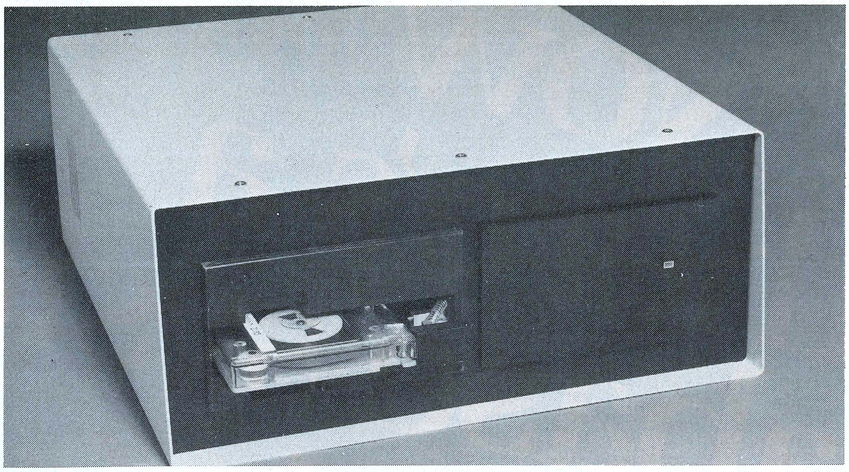

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mands, when they are all stacked together, look like this:

```
A>find "Los Angeles" table  >temp1
A>sort /+40  <temp1  >temp2
A>copy temp2 prn
```

To simplify the process we could prepare a batch file containing all of these commands. We could even go a step further and use a replaceable parameter for the search string. Doing so does limit us in one respect, however: The string cannot contain a space, since replaceable parameters cannot pass spaces. We could use a replaceable parameter to find vendors in Chicago, or Angeles or Los or York, but not Los Angeles or New York (although the effects would almost always be the same). In this case, the batch file would contain the following:

```
A>copy con: mytest.bat
find "%1" table  >temp1
sort /+40  <temp1  >temp2
copy temp2 prn
^Z
```

Now when the command

```
A>mytest Angeles
```

is submitted, the same report will result.

This exercise shows how powerful the DOS shell can be. And there's still another capability that can speed things up even more—the pipes we talked about earlier. We'll see how in a minute.

First, though, recall for a second that a pipe allows the standard output of one DOS command to be routed to the standard input of another. The classic example of piping uses the *sort* filter to sort the output of the *dir* command. This can be done rather inelegantly using redirection

```
A>dir  >temp3
A>sort  <temp3
```

which prints a directory on the screen, sorted alphabetically. This is a sloppy way to do the job, however: Not only does it require two commands, we have created yet another temporary file. Too much of this and we'll have our disk thoroughly cluttered up.

The piping feature of DOS allows us to accomplish the same thing without all the fuss of having to name and create a temporary file and then delete it when we are done. A pipe lets us send the output of the *dir* command directly to the input of the *sort* command, with no need for us to create a middleman file

```
A>dir ¦ sort
```

where the ¦ character denotes a pipeline from the output of the command on the left to the input of the command on the right.

In executing this command, DOS does actually create a temporary intermediate file; when it is done with the intermediate file, it also takes care of deleting it. Now, suppose we could further pipe the output of the *sort* filter into the *find* filter, perhaps to find all of the files created on a certain day. This can be done quite easily by entering

```
A>dir ¦ sort ¦ find " 9-05-83"
```

and if this finds so many directory entries that they casually scroll off the top of the screen, you could send the output of the entire schmegegie to the *more* filter, causing it to halt after each screenful.

```
A>dir ¦ sort ¦ find "9-05-83" ¦ more
```

Now that we have a pretty good understanding of pipes, let's go back and take another look at the earlier example of finding LA vendors, sorting them, and printing the list. You'll recall that we solved that problem by using a series of three commands, each using one or two temporary files:

```
A>find "Los Angeles" table  >temp1
A>sort /+40  <temp1  >temp2
A>copy temp2 prn:
```

We can see that we are sending the output of the first command to a temporary file, and then using that file as the input to the second command. Well, since that's exactly what a pipe does, why not replace the redirected output to the temporary file (>temp1) in the first command, and the redirected input from the same file in the second command (<temp 1), with a single pipe:

```
A>find "Los Angeles" table ¦ sort /+40  >temp2
A>copy temp2 prn:
```

No sense stopping there, though; instead of redirecting the output of the first command to a temporary file, and then printing that file, we could simply redirect it straight to the printer:

```
A>find "Los Angeles" table ¦ sort /+40  >prn:
```

which collapses the entire solution into a single command line. As before, if you expect to use the facility often, it could be stored as a batch file with replaceable parameters.

Because of the peculiarities of the *sort* command—the field that *sort* is working on must start in the same column in each record—the type of file that it can work on is limited to files with fixed field lengths. Such files are quite common in the computer world, however.

Database management and personal filing systems will have the capabilities of *find* and *sort* built in. DOS's abilities vis-a-vis these dedicated systems is limited, and the operating system is certainly not meant to replace such programs. It does, however, offer an extremely flexible tool for on-the-fly generation of reports or test processes.

Next month we'll dig a little deeper into the subject of pipes and filters. If you have created the sample files that we used in these examples you should keep them around, since we'll be massaging them in different ways. By combining the features that we've just learned about with I/O redirection and batch commands, we'll see how we can create a whole catalog of entirely new commands out of the few supplied with DOS. ▲

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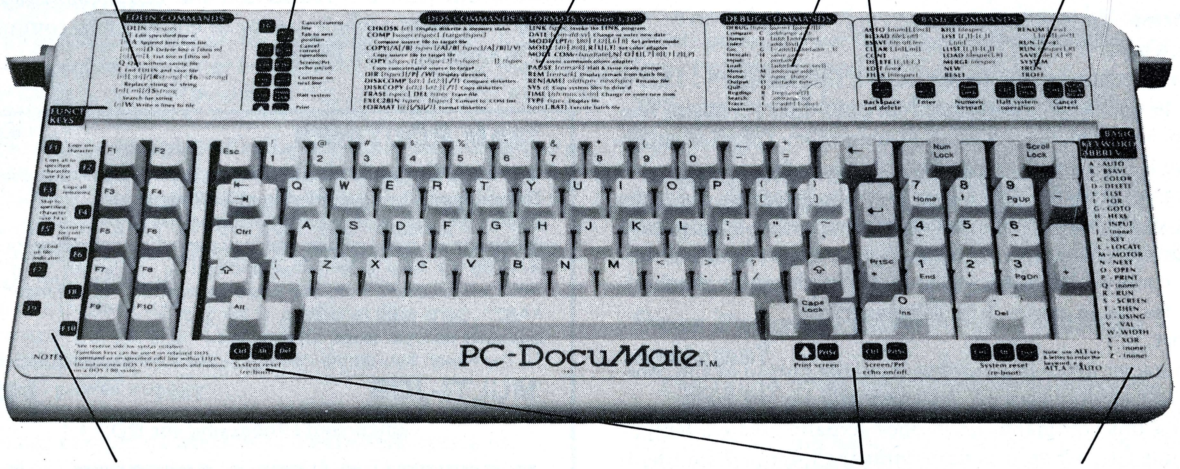

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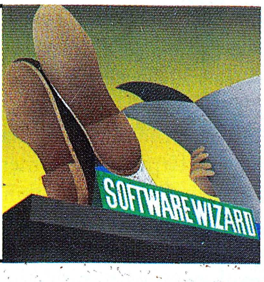

Δ **Information Unlimited Software** (Sausalito, CA) has announced its acquisition by **Computer Associates International** (Jericho, NY), developer of mainframe and minicomputer software. According to **Bill Baker**, former IUS president, "The merger with a public company with sales of more than $58 million last year will not only broaden our distribution channels and product line, but will also enhance delivery of innovative services, technical support, and products to the marketplace." Baker has returned to the area of new product development, where he began with IUS. New company president is **Stefan Bothe**, who retains his title of senior vice president of marketing with Computer Associates. IUS products will continue to appear under the IUS banner, becoming a division of the parent company. IUS's sales and marketing department has been split in two: the new vice president of marketing is **Mark Farnell**. The position of vice president of sales is currently vacant, **William Lohse** having resigned.

Δ Street prostitution has reached epic proportions in Hollywood, California, over the last few years, as thousands of hookers (female) and hustlers (male) have set up shop in Tinseltown. Recently, the Hollywood Chamber of Commerce raised ninety thousand dollars to install an XT in the Hollywood Division of the Los Angeles Police Department for the specific purpose of coping with the vice enforcement problem. A database system that holds prostitution arrest information, called HAVES (Hollywood Area Vice Enforcement System), now runs on the LAPD's first personal computer. The system was created in *dBase II* by **John Cappelletti Associates** (Irvine, CA), in cooperation with the Hollywood Division Vice Enforcement Detail. "It's about the most complex and sophisticated application of *dBase* that you're likely to see," says a company programmer. The system tracks an arrested prostitution suspect by AKA as well as by physical characteristics (including fingerprint digitization). AKAs are often used by repeat offenders to get a reduced sentence; second convictions carry a forty-five-day sentence and third convictions mean ninety days. HAVES prints arrest records, court tracking information, citations, and field interviews for use by the city attorney's office in preparation for a case against the arrested party. A series of reports on active warrants, open cases, cases rejected, custody status, and so on can also be generated. The database holds the facts on more than six thousand prostitution arrestees, half of them male. Although the Hollywood Division has terminal access to some of this information on an LAPD mini, most of it was previously contained in bulging file cabinets.

LAPD's first pc was welcomed by Mayor Tom Bradley and (pictured) John Capaletti.

Δ Startup: **American CompuSoft** (Laguna Hills, CA) is the name of a new company that plans to develop CP/M software exclusively. Their first product is a CP/M-to-MS-DOS conversion package. The company, headed by **Larry Brissenden**, has also acquired the assets of The Software Establishment (Westlake Village, CA). A series of accounting and service billing application programs will continue under the new company banner.

Δ An eight-year-old manufacturer of industrial—and now personal computer—modem products, **Ven-Tel** (Santa Clara, CA) has signed an agreement with **ComputerLand** (Hayward, CA) to distribute their PC-Modem firmware and software line. The company plans to support their new distribution channel with toll-free customer service lines.

Δ The former software manager for **Hamilton Micro Systems** (Torrance, CA), **Art Hill**, has accepted a position as national accounts manager with **CYMA** (Mesa, AZ). Prior to joining the firm, Hill was software manager for Data Systems of Arizona, a Basic Four dealership.

Δ In the first of several grand openings planned for 1983, the seventh location of **ComputerCraft** (Houston, TX) has opened its doors. It's a thirty-two-hundred-square-foot store located in the Custom Hi-Fi Center on Interstate 45. The aggressive local dealer provides sales, service, and training.

Δ Dealers, reps, and distributors of **Applied Software Technology** (Los Gatos, CA) can place product orders and get prices, order status, and marketing information at (800) 551-1500 (outside California). For technical support, dial (800) 282-2026. The inside-California number remains (408) 370-2662.

Δ **CompuShop** (Chicago, IL) has been signed as an authorized dealer for **Compaq** (Houston, TX). The company, with twenty-one

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stores in the Midwest, began with one outlet in Richardson, Texas, in 1977.

Δ **Arthur Kohler** has joined **Electronic Protection Devices** (Waltham, MA) as executive vice president of sales and marketing. Kohler comes from Fotobeam, a reprographic firm, and is a member of the Massachusetts Bar Association with a doctorate from the Boston University School of Law.

Δ A firm that will bring together software developers with publishers throughout the country has been formed by **Carolyn J. Kuhn**, a former Control Data executive. **Software Mart** (Austin, TX) will serve in the traditional role of agent between parties. "Agents have always been an important part of the traditional publishing business," says Kuhn, whose background includes both traditional and electronic publishing. "They are among the front-line marketing minds of the publishing industry." The company will aid in the conversion of existing products and the acquisition and development of new ones.

Δ A former salesperson with IUS, **Michele Whitman**, has gone into her own business—computer age greeting cards. Her company, **Computer Greetings** (San Leandro, CA), markets a line of floppy-disk-sized, "high-tech-humor" greeting cards for all occasions. Categories include invitations ("You are invited for a byte at my place"), get well cards ("Got a bug in your system?"), friendship ("I'm user-friendly, are you?), and expressions of love and related passions ("I like your baud").

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Δ Door prizes, auctions, and "a bit of craziness" highlighted **Computer Swap America**, a personal computer bargain show held earlier this month at the Santa Clara County Fairgrounds (Santa Clara, CA). More than three hundred fifty sellers offered eight hours of intensive no-frills wheeling and dealing. A "personal computing milestone exhibit" displayed some of the first hobbyist computer systems, such as the Altair 8800 and the Mark-8. The yearly "good times and good deals" event began in 1976, the brainchild of **John Craig**, then editor of *Microcomputing, Creative Computing*, and, later, founding publisher of *InfoWorld*.

Δ *Write, Edit, & Print: Word Processing with Personal Computers*, a book published by **Design Enterprises** (San Francisco, CA), was chosen by *Typeworld*, the typesetting industry trade newspaper, as an outstanding example of a trade book. The book-and-disk combination took home the first annual award for typographic excellence for a trade book typeset by telecommunications.

Δ **BusinessLand** (San Jose, CA), with six computer stores in the San Francisco Bay Area, has moved southwest into the sun by acquiring **Dataplace Computer Store** (Phoenix, AZ), a three-store chain. **Harvey Golomb**, founder of Dataplace, will serve as vice president of BusinessLand and **William E. Thomas**, former operations manager, will become assistant district manager for the company.

Δ Following the model of book publishers, **International Microcomputer Software** (San Anselmo, CA) is a new software publisher that will rely on product from free-lance authors exclusively and will provide royalties on sales as well as design and documentation assistance. At the moment, primary focus is on business, home management, and educational programs. Authors may be attracted to some of the names on the company's advisory board: **Rob Barnaby** (*WordStar*) and **Denis Coleman** (*Spellguard*).

Δ The **McGraw-Hill Book Company** (New York, NY) and **Software Arts** (Wellesley, MA) have announced the signing of a major agreement for the development of application software. McGraw-Hill will immediately begin to produce, market, and distribute *TK!SolverPaks*, software for use with Software Arts's *TK!Solver* program. The new packages will be based on technical and professional books published by the company. Titles will be selected from major reference handbooks in five key engineering areas: chemical, civil, electrical, electronic, and mechanical. Future titles will expand into business and technical categories. Δ McGraw-Hill has also acquired **Aardvark Software** (Milwaukee, WI), a tax-planning application program developer. The software firm, founded in 1979, will operate as a division of the book company. **Donald C. Cook**, a cofounder of Aardvark, will continue as its president and will report to **Robert Biewen**, executive vice president, professional and general publishing, at McGraw-Hill.

Δ A new moniker: **Softeam** is the new company name for **Software Distributors** (Culver City, CA). Softeam, which ships to more than three thousand dealers worldwide, expects it will take about six months for the new name to catch on.

Δ A new electronic agricultural business information service begins this month in Canada. **AgriData Resources** (New York, NY) has announced the availability north of the border of the company's AgriData Network/AgriStar Service, already available in the United States; the service will be supplemented by Canadian market, weather, and news reports. More than five hundred Radio Shack and other independent computer stores will be used as demonstration centers. The system will be accessible from Telidon videotext terminals, according to a company spokesman, as well as via personal computers. "If someone has a Telidon terminal and wants to see Winnipeg grain prices in living color, we can do it."

Δ **Individual Software** (Redwood City, CA) has signed an agreement with **IBM** (Boca Raton, FL) for the distribution of their software training package, *The Instructor*, in all IBM Product Centers. Δ **Random House** (Tulsa, OK) has also signed with IBM to convert nine of their bestselling microcomputer programs to run on the pc. The programs will be redesigned to maximize the capability of the machine.

Δ **Lotus Development** (Cambridge, MA) has announced the appointment of **Marv Goldschmitt** to the new position of vice president of business development. Goldschmitt will be responsible for the development of training programs, international marketing, and computer manufacturer relationships. Previously director of product marketing, he will report directly to Mitch Kapor, company founder and president. Prior to joining Lotus last August, Goldschmitt was director of marketing for Software Resources, and before that he managed a Computer Store outlet.

Δ The **PC Centre** (Santa Clara, CA) is a new retail chain devoted exclusively to the IBM pc. A division of **Marketex Computer** (Sunnyvale, CA), PC Centre opened its first store on the busy El Camino Real in Santa Clara; three more stores are planned by year's end. ▲

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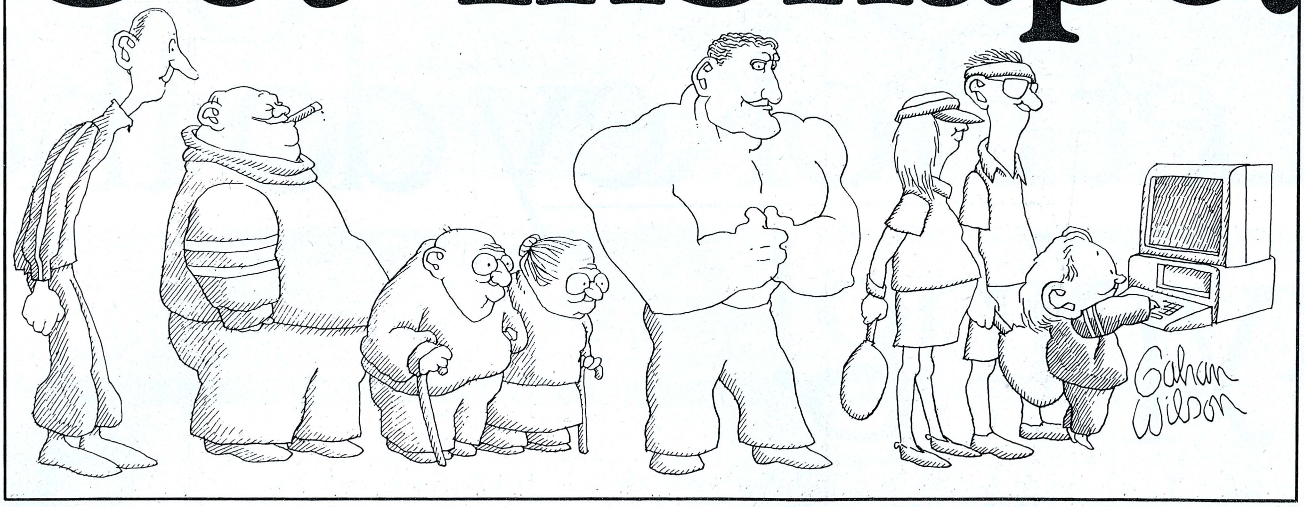

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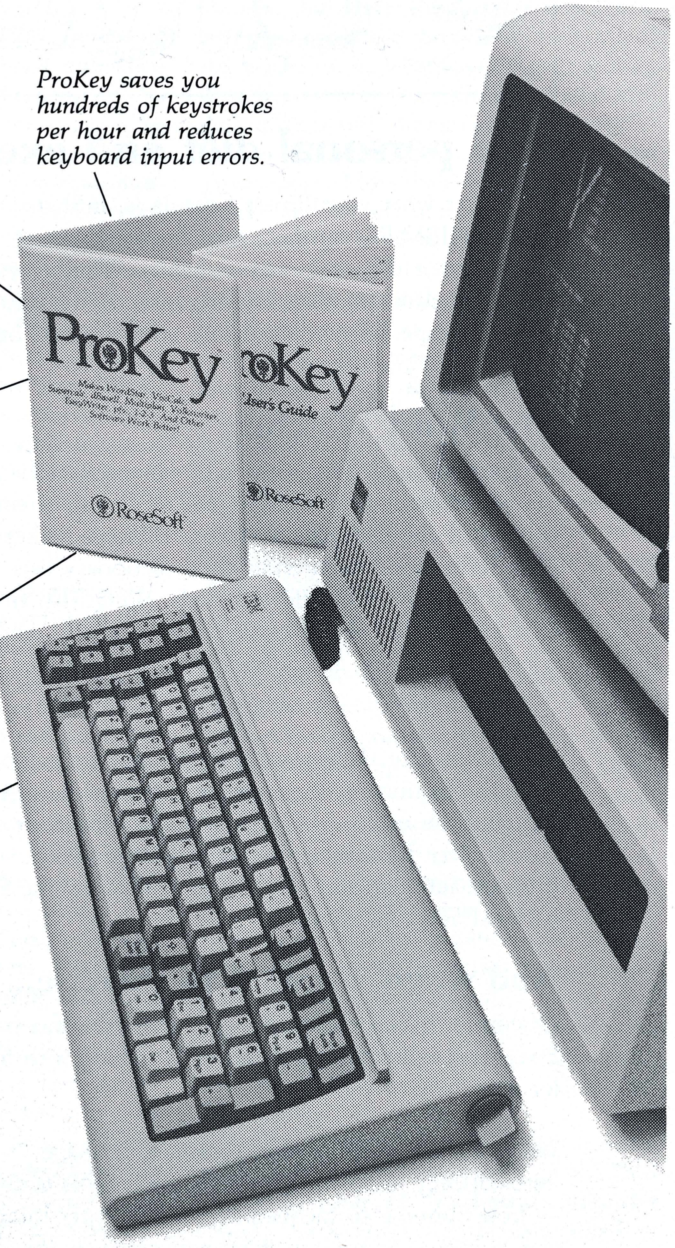

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Of Portability and Compatibility

CLOSEUP WITH THE COMPAQ

by John Socha

Of all the allegedly pc-compatible computers on the market today, none has been more popular than the Compaq. Part of the reason for this popularity is that the Compaq really is more compatible with the IBM pc than are most of its competitors.

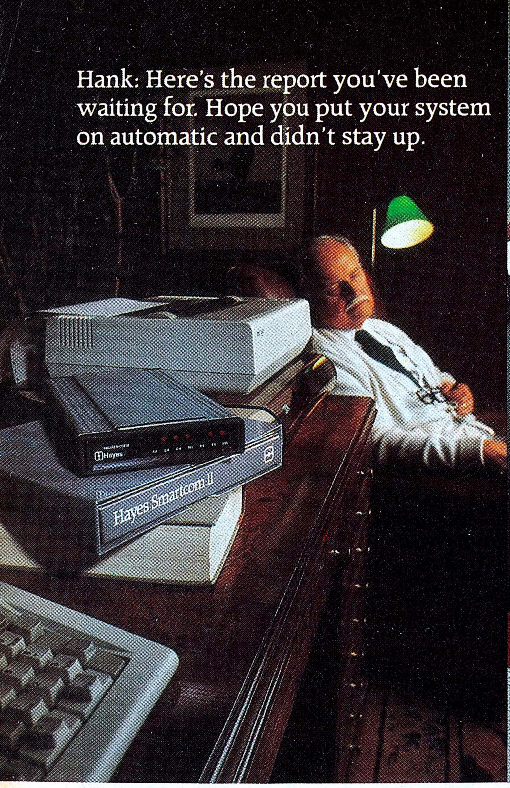
Simply calling a computer pc-compatible unfortunately doesn't make it so: Many of the look-almost-alikes on the market have subtle or not so subtle design differences from the pc that prevent at least some pc programs from running.

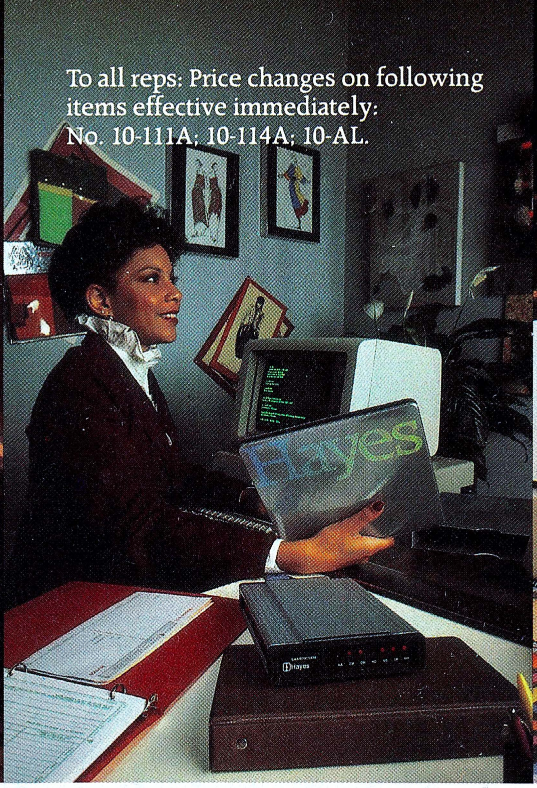
The Compatibility Issue. A microprocessor chip, such as the 8088 used in the IBM pc, is the heart of any pc-compatible computer. Some compatibles may use the sixteen-bit-bus 8086, others the newer 80186 or 80286; if done properly, such substitutions need have little or no effect on compatibility. But even with a clone or kissing cousin under the hood, there are at least four other levels at which compatibility can be torpedoed; in the hardware, in the disk operating system software (DOS), in the basic input-output system firmware (the ROM BIOS), and in the manufacturer-supplied system-level software (for example, the Basic interpreter).

Hardware such as disk drives, video displays, and keyboards surround the microprocessor; this is where the lowest level, hardware incompatibilities, appear. One "compatible" computer, for example, uses three-inch disk drives rather than the IBM standard 5¼-inch disks, so an IBM pc can't even read the same disks—hardly a good start for a compatible computer. Another "compatible" uses a graphic display that resembles the pc's, yet its hardware interface to the keyboard is different, so *Microsoft Flight Simulator* doesn't work. Other hardware differences can be far more subtle: from the surface, things look compatible, but some programs don't run right.

Despite the fact that most compatible computers are not entirely compatible on the hardware level, they can still claim to be compatible at the software level. That's because well-behaved application programs don't access the computer's hardware resources directly but go instead by way of the operating system. It's the operating system that is concerned with the low-level details of a particular piece of hardware and that knows the difference between, say, a hard disk and a floppy disk. The application program simply asks to read a file, letting the operating system take care of such minutiae as determining how many sectors are used per track or whether the data is coming from a hard disk or a floppy; the application program doesn't know and doesn't care. Thus an operating system for a compatible computer can be customized to deal with the computer's unique hardware and nevertheless look to an application program just like ordinary PC-DOS.

While a pc clone obviously needs compatibility at the PC-DOS (or operating sys-


Hank: Here's the report you've been waiting for. Hope you put your system on automatic and didn't stay up.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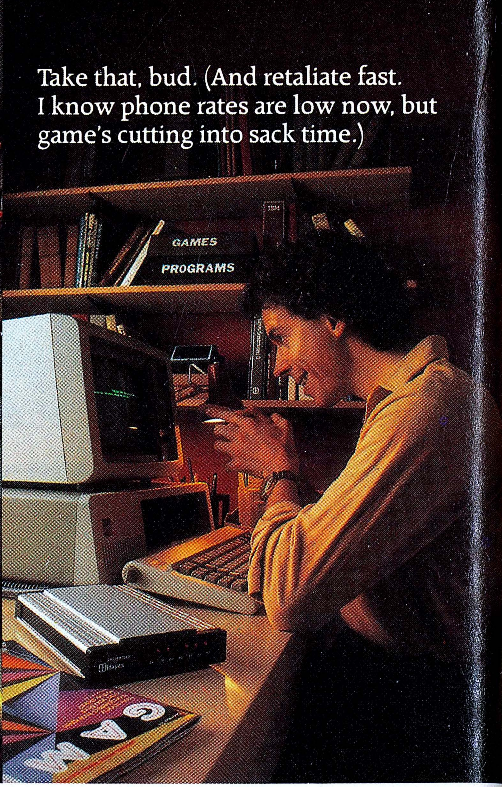
Take that, bud. (And retaliate fast. I know phone rates are low now, but game's cutting into sack time.)

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More than any other peripheral, a modem vastly extends the usefulness of your IBM. So it's important to get the best modem for your money. (One with a limited 2-year warranty.) The Smartmodem 300 is a wise choice. Far superior to acoustic coupler modems, which connect to the telephone receiver. And it's so easy to use.

It dials, answers and disconnects calls automatically, operating with rotary dials, Touch-Tone* and key-set systems. It works at full or half duplex, which simply means that connecting to a time-sharing system, while a big deal, is no big deal to do.

Indicator lights let you see what your Smartmodem is doing, while an audio speaker lets you hear it. (Is the remote system down, or was the line just busy? This way, you'll know.)

Now all these extras aren't absolutely necessary. We could have gotten by without them. But at Hayes, we're not satisfied with just "getting by." That's why we made the Smartmodem 300 so—well, smart. You can even program it. And we've even provided one for you!

Announcing Smartcom II.™ The communications program designed by Hayes specifically for the Smartmodem. If ever there was friendly software, the Smartcom II is it!

The first time out, you'll be creating messages, sending them, printing them and storing them to disk. Simultaneously.

Likewise, when you're on the receiving end. Only you really don't need to be. With Smartcom II and your Smartmodem 300, your computer does it all, completely unattended! That's especially helpful if you're sending work from home to the office, or vice versa.

But it's just part of the story. For instance, before you communicate with another system, you need to "set up" your computer to match the way the remote system transmits data. With Smartcom II, you do this only once, the first time. After that, the information (called parameters) is stored in a directory on the Smartcom II. Calling or answering a system listed in the directory requires just a few quick keystrokes.

You can store lengthy log-on sequences the same way. Press one key, and the Smartcom II automatically executes a whole string of numbers to connect you to a utility or information service.

And if you need it, there's always "help." Even while you're on-line, the screen will display explanations about a

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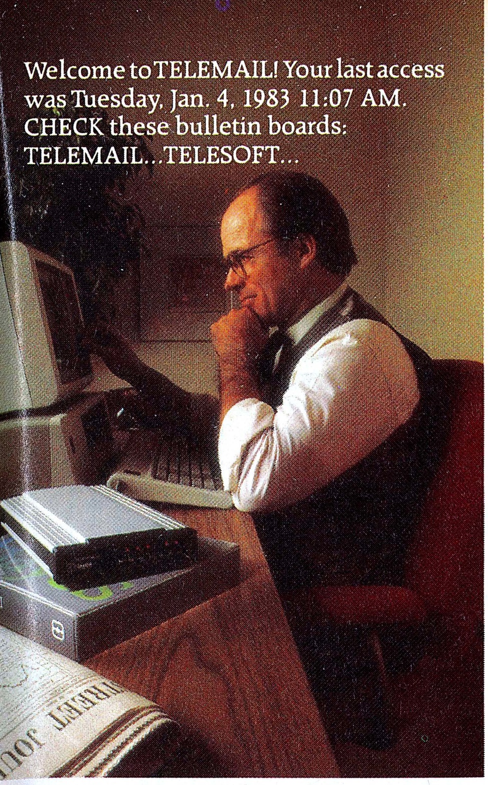
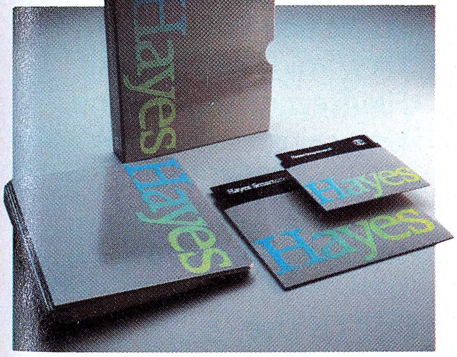

Welcome to TELEMAIL! Your last access
was Tuesday, Jan. 4, 1983 11:07 AM.
CHECK these bulletin boards:
TELEMAIL...TELESOFT...

prompt, message or parameter that will get you on your way in no time.

Smartcom II also provides a directory of the files stored on your disk. You can create, display, list, name, re-name or erase any file right from the Smartcom II screen.



And now Smartcom II is available for the IBM PC.**

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So see him today. Link up to the exciting world of telecomputing. Get a telephone for your IBM PC.

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tem) level, that alone doesn't guarantee much. As an example of the kind of problem that can occur even with DOS-level compatibility, consider a word processor or spreadsheet program running under DOS 1.1. A word processor obviously needs to be able to move the cursor around the screen. Unfortunately, prior to version 2.0, PC-DOS provides absolutely no way to move the cursor, so a word processor that runs in DOS 1.1 has to call on cursor routines in the ROM BIOS (read-only-memory basic input-output system). If a computer is to run a word processor written for the IBM pc, it must be compatible with the pc at both the disk operating system *and* ROM BIOS levels.

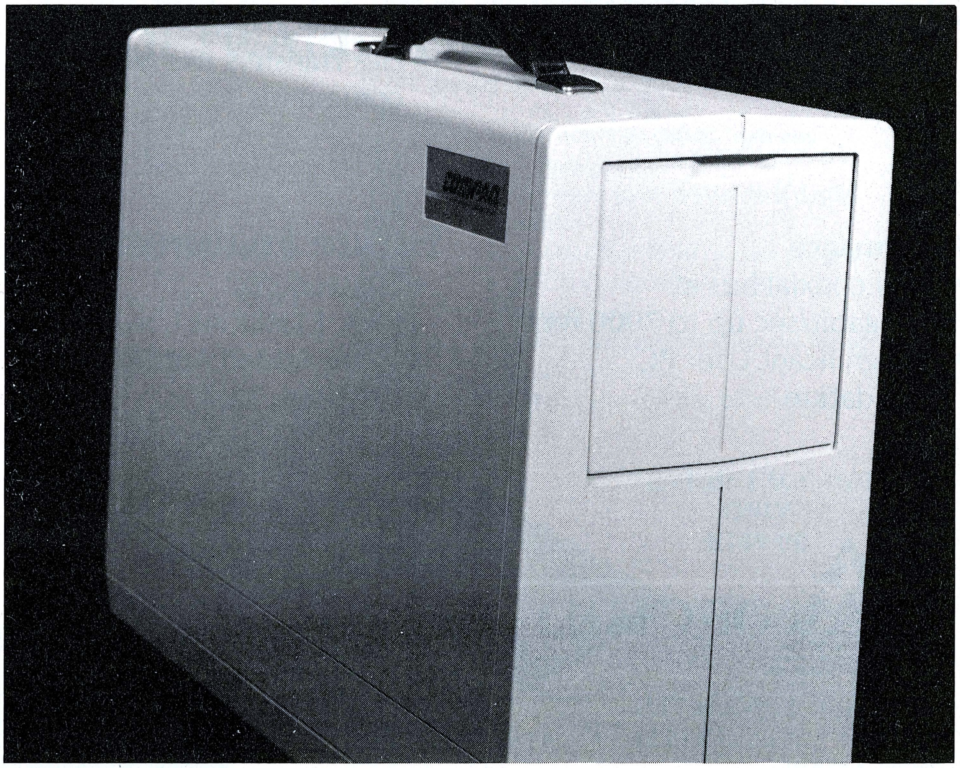
Some would-be pc clones successfully clear all these obstacles to compatibility and still fail the ultimate test of being able to run any pc program. That's because there's still another place to trip up: at the manufacturer-supplied system-level software. While compatibility at this level would appear to be pretty easy to achieve, not all compatibles manage it. The slip-up here is in Basic: While the compatible manufacturers get their Basic from Microsoft, they don't all get the same version.

There can be two reasons, at least, for differences in Basic. The first is that the manufacturer may have requested changes to accommodate his unique hardware. In this case, the differences in Basic are really no more than a reflection of differences in the hardware. The second reason is that the IBM pc stores most of its Basic in ROM, whereas most compatibles store the language in RAM. The ROM basic was written expressly for IBM and is slightly different from the MS-DOS versions (that is, slightly different from the generic version that Microsoft sells to its other customers).

The Compaq is almost entirely compatible with the IBM pc on the first three levels—hardware, BIOS, and DOS. On the last level, there are minor, but very nearly inconsequential, differences between the Compaq and the pc.

Travels with Compaq. The Compaq is a sleek, attractive unit, its front dominated by a nine-inch green screen and one or two disk drives. Although the computer is portable—the keyboard folds up to form the bottom of a neatly self-contained unit, and it has a handle on top—at thirty-two pounds (with two disk drives) it's a bit heavy to carry on the subway. Or on a train, plane, or elevator, for that matter. Granted, it *can* be delivered from place to place by one person. And granted, other portables, such as the Osborne, are just as cumbersome. The Compaq is still not as portable as you'd like it to be. Schleppable would probably be a better description.

Compaq is very secretive about the innards of its machine, offering no clues, let alone diagrams a la IBM's *Technical Reference* manual, on how to add expansion boards. As a matter of fact, the manual doesn't even tell you how to open up the machine in the first place. (Here's how it's done; don't tell Compaq we told you. Pop off the plastic exterior by applying a bit of



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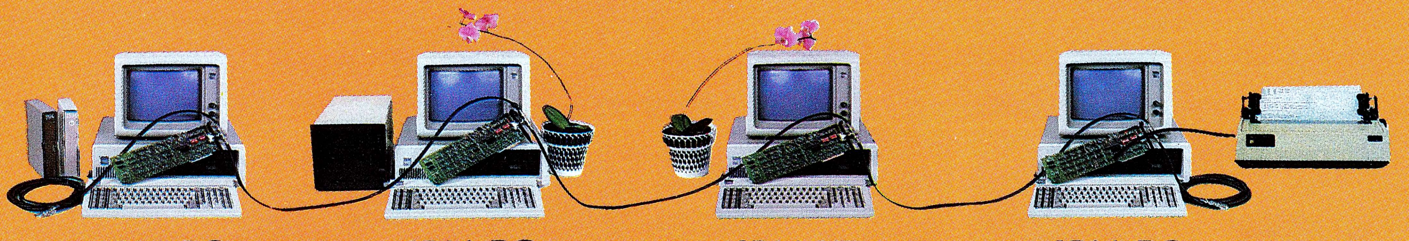

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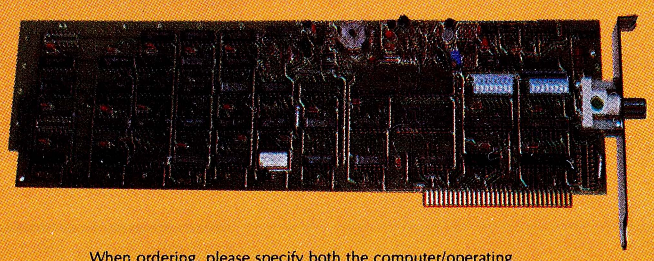

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force near the back. Underneath, you'll find a perforated metal cover, secured by several small and ornery Phillips head screws. You don't have to remove these screws; just loosen them.)

The system board bears some likeness to the pc's and includes two dip switches, marked SW1 and SW2, that function just like the corresponding switches on the pc. Considering those extra expansion slots, it's a mystery why Compaq neglects to include instructions for adding boards. Do they think every Compaq owner has access to IBM's manuals? Or do they intend the owner to return the machine to a dealer every time he wants to add a board?

The motherboard carries 128K, which is standard, and bears sockets for an additional 128K. Almost hidden is a socket for the 8087 math coprocessor chip.

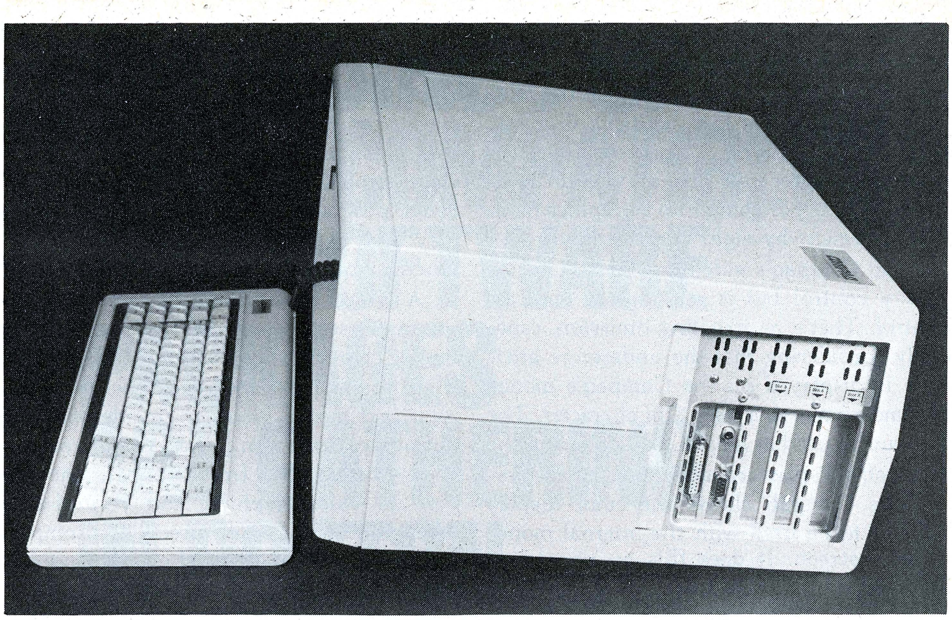
Although the sockets into which expansion boards plug are identical to those used in the pc, the card cage is somewhat larger, leaving extra room between the bottom of large boards and the system board. That should please those who object to the fact that bottom-heavy IBM boards touch ICs on the pc system board. The Compaq also has extra room above each board; the designers made use of that extra room to cram both a dual display adapter (both monochrome and color/graphics) onto a single oversized board; like IBM's mono display adapter, the Compaq display card includes a parallel printer port. The disk controller board occupies a second slot, leaving three slots free.

IBM's disk controller board can be used with four disk drives, two internal and two external. Compaq's adapter supports only the two internal disk drives. That's a reasonable design compromise, considering that this is a portable machine.

The keyboard has a very different feel from IBM's. IBM chose a keyboard with a very pronounced tactile feedback—a loud key click. Some users find this feature objectionable in an office environment. The Compaq, in contrast, uses a "spongy" keyboard with no tactile feedback. The keys are softer than those on the pc and make for faster touch-typing.

For those who like tactile feedback, the Compaq offers a software-controlled key click (the sound is emitted from the computer's speaker). You can control the volume of this key click in two different ways. The simpler method is to hold down control and alt with your left hand and hit the gray plus sign or minus sign (plus to make the click louder, minus to make it softer). You can do this at any time, from within any application program. The volume range extends from zip (you can turn the click off altogether) to beep.

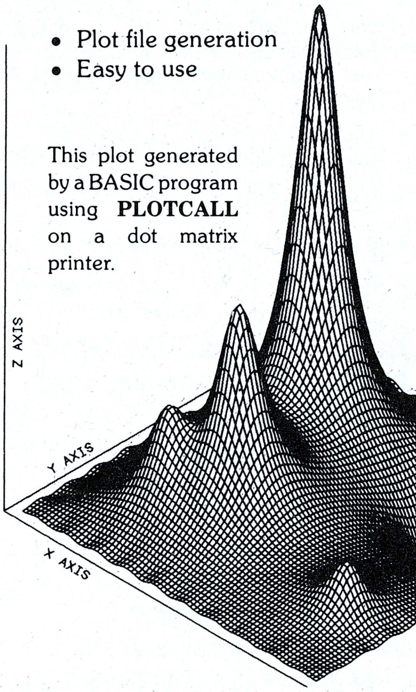
The other way to control key click is to alter memory location 40:6A, which stores the volume information. A 00 here silences the keyboard, while FF puts it up full blast (the default value is 01, which produces an audible but unobtrusive tick). This memory location on the IBM stores data for the cassette interface, which doesn't exist on the Compaq.



Peripheral boards communicate with the outside world from behind a sliding door on the right side of the Compaq.

Show Me. The video display system in the Compaq is very different from the pc's in design, yet it functions much the same. Although Compaq designed the display system with both the monochrome and color adapters on the same board, the portable manages to retain almost complete compatibility with a stock IBM pc using the color/graphics adapter—a neat trick.

The integral display uses a long-persistence green phosphor—the same phosphor



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found on the IBM monochrome display. Characters on the display appear to be the same as those produced by the two IBM display boards. When you boot the Compaq, you come up looking at a nine-by-fourteen-matrix character set, just as you do on a monochrome pc; going into a graphics mode gives an eight-by-eight character set.

The Compaq's video display has an intensity control but is missing the contrast control. That's an irritating omission, especially considering that the underscore attribute is displayed on the Compaq's monochrome screen as a very dim character. The attribute is used as a color, and colors on the Compaq's display are of different intensities.

The Compaq allows the color display adapter to be used with the internal monochrome screen. It does this by translating colors into brightness levels. As a result, the monochrome screen can be used easily and with little eyestrain for games and other programs that use color. That's an improvement over the IBM, which displays different colors on a black-and-white screen as closely spaced vertical lines. Try IBM's *Ball* demo program on a black-and-white display and you'll see just how poorly their scheme works.

A Minor Incompatibility. Both display adapters use the same area of memory for storing characters, so text stays on the screen when you switch between monochrome and color text modes (you can, incidentally, do this at any time from the keyboard; control-alt-< switches you from monochrome display to color/graphics, and control-alt-> takes you in the other direction). Compare this to the method of switching displays presented in "the Color/Monochrome Switch," parts 1 and 2 (*Softalk*, February and April 1983), which clears the display when switching modes.

But some software adamantly denies the existence of a monochrome display mode on the Compaq by forcing the display to the graphics adapter. Other software runs aground by assuming that an IBM monochrome adapter exists and trying to write to a different area of memory, as it would for the IBM mono display. Let's see why, and in the process we'll see where the Compaq display is and isn't pc-compatible.

The ROM BIOS routines inside an IBM pc know of eight different display modes (see the aforementioned articles)—seven for the color/graphics adapter and one for the monochrome. Another area in memory tells these routines which display adapter is actually installed in the machine.

Some programs use this mode information to determine the type of display adapter to use. Such programs present no problem on the Compaq, provided they don't try to write directly to the display memory. If they do, then there may be a problem, because whereas the pc uses different areas of memory for its two display adapters (B0000H for monochrome and B8000H for color/graphics), the Compaq uses only one—the area starting at B8000H. Programs that write directly to screen memory can still be run on the Compaq, but the user has to switch to the color/graphics display from the keyboard (by pressing control-alt-<) and has to sacrifice the clear, high-resolution, monochrome display.

Fortunately, there's another, better method for finding the location of display memory. The ROM BIOS routines use one word of memory, called EQUIP_FLAG, to store information about installed equipment. On the Compaq, this word of memory always says that a color/graphics adapter is installed; never does it say a monochrome adapter is installed. So software that uses this information to find the display memory won't run aground. It may, however, use the color/graphics adapter when, on the pc, it would use the monochrome; *Microsoft Adventure*, for example, switches the Compaq display from the monochrome mode to the forty-column color mode.

In Conclusion. The Compaq is a very well-designed machine—in some ways even better designed than the IBM pc. If the showing at the last Comdex trade exhibition is any indication, the Compaq is very popular among independent hardware and software vendors: They were using scores of them in preference to pcs to demonstrate their wares. Those few software packages that aren't compatible with the Compaq—most such programs are written in Basic—will probably be modified quickly. ➤

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IS THE COMPAQ COMPATIBLE WITH YOU?

The question of the Compaq's compatibility with the IBM Personal Computer seems to have been resolved (see companion article): Virtually everything written for the pc runs as well on the Compaq. That's not to say you can't write a program for one machine that won't fly on the other. Certainly it can be done. But it's more than reasonably safe to base a buying decision on the assumption that you'll be able to run everything your desk-bound pc-owning friends can run.

The question then becomes, "Do you want this machine?" *Should* you buy the Compaq in preference to—or in addition to—the pc? With a view toward answering that, here are some observations about what it's like to use a Compaq.

Portability. The machine is heavy, make no mistake. You can carry it, but you'll wish it had wheels, especially on those long walks from curb to jetway.

Weight aside, the Compaq is a neat package. It's got a padded handle on one end, and the keyboard detaches from the other end. On the sides are two little compartments with sliding doors to seal them off for travel. One side houses the on-off switch and power cord connection (the cord can be stuffed into this compartment when you hit the road). The other side presents connectors for your printer, an external monitor, and whatever else you may wish to attach.

The machine fits under a coach airline seat but leaves no room for briefcase or legs. You'll probably want to stow it with the garment bags up front; otherwise you'll find yourself waiting until everyone else gets off the plane so you won't clobber them in the aisles.

The Display. Very possibly the neatest thing about working with a Compaq is the fact that you have the equivalent of *both* IBM display adapters driving a single CRT. For text processing you get what appears to be an exact replication of the IBM monochrome character set. And if you don't mind sacrificing color, you can run graphics software as well.

If you're used to working with IBM's mono screen, you may be a little concerned about switching from a thirteen-inch to a nine-inch display. This writer, however, has found that eight hours or more a day in front of the Compaq green screen produces no serious eye fatigue. Thank the nine-by-fourteen-character matrix for that. This isn't to say, however, that nine inches is an adequate display for everyone; if you intend to do a lot of text work, give yourself a lengthy tryout in the store before you buy a Compaq. Bear in mind that, while you *can* hook up an external monitor (and write nine-by-fourteen characters on it), you *cannot* attach IBM's monochrome screen to the Compaq; the IBM display works only with the IBM Personal Computer.

The Keyboard. From an ergonomic standpoint, the biggest difference between the pc and the Compaq lies under your fingers. The Compaq keyboard has the same layout as the IBM but a very different feel. It has what a pianist would call a light action, which means that it takes relatively little force to depress a key.

Light-action keyboards have advantages and disadvantages—on computers as well as pianos. The chief advantage is that they let you play faster. The chief drawback is that they make you more prone to error. It's much easier to make a key speak out of turn on the Compaq than on the pc.

If you're a relatively slow typist and if key resistance imposes any speed limitation at all, you'll probably love the Compaq. If you're already nimble you may well hate it. But of course this is a matter on which nobody's advice is worth a damn to you: Hie yourself into the store and try the thing out.

Here are some other, more objective comments about typing on the Compaq.

The built-in display seems to be designed for use at dining-room-table level (and, presumably, hotel-room-table level), rather than at typing-table level. If you're a person of reasonable height and you work at a typing desk, you're likely to find the CRT aimed at your chest instead of your eyeballs. You may need an advertising catalog to prop it up.

The keyboard cable comes out the front of the machine instead of the back. That's a big improvement over the pc. Unfortunately, it's permanently attached at both ends, so you can't swap it for a longer cable. And while you can put the keyboard in your lap, you won't want to; the tension on the cable is too great to permit lap typing. For that matter, it's very nearly too much for table typing.

Finally, there's a potentially disastrous bug in the Compaq's keyboard I/O routines (at least on *Softalk*'s review unit): If you have a printer interface installed but no printer attached, and you hit shift printscreen by mistake, your machine goes to lunch and doesn't return. Nothing to do but reboot. When you're on the road, of course, you probably won't have your printer hooked up, so beware, you might want to write or have someone write a program to disable at least the right-shift-and-printscreen combination (that's fairly simple to do; *Softalk* will publish such a routine next month); you could then stuff the printscreen disabler into a traveling autoexec file.

Noise. The fan is louder than IBM's, but the disk drives are quieter. You'll love those drives; unless you work in a library, you'll hardly hear them at all. And since the fan noise is constant you'll probably tune it out when you work. As for keyboard noise, that's up to you. The keys click through the speaker at a user-controllable volume (see the accompanying article). You can make the keyboard close to silent or entertain your neighbors with it, according to your preference.

The Bottom Line. So. Is this the machine you want? To help *you* decide, here are some other questions to think about.

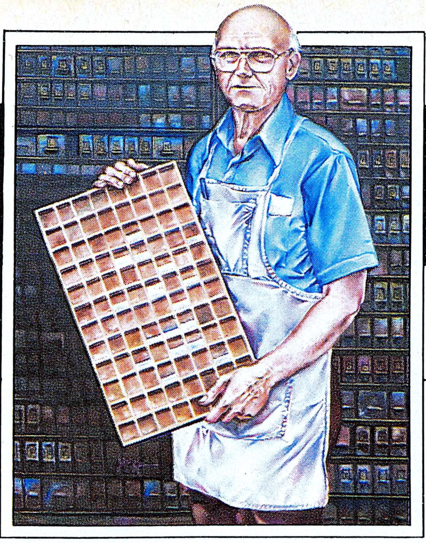
How important to you is IBM's name? This isn't a trivial matter. The Compaq apes the pc beautifully as things stand today, but one never knows what IBM may do in the future. Maybe it'll provide a field-installable upgrade for the pc that won't be available on the Compaq.

How great is your need for a traveling computer? How often do you travel and how do you travel? If you want a machine that you can take home—by car—for the evening or the weekend, the Compaq should serve you well. If you're looking for a field-reporting unit to take frequently on planes or trains, you might do better with a less ambitious but more totable companion. If you don't *need* to run *1-2-3* in your hotel room but do need to be able to send text home over the wire, there are lighter, less expensive alternatives (Radio Shack and Epson, among others) to consider.

And finally there is the Peanut question. Depending on what you do with your computer, it's conceivable that IBM's newest offspring will provide enough computing power, portability, and pc-compatibility to serve your needs without costing you the comfort of the Big Blue logo. If rumors are to be trusted, we'll know the answer to that one soon.

Whether the Compaq is for you depends on your needs and tastes. Obviously we can't answer that question. What we can do is assure you that from the standpoint of both functionality and ergonomic design, it's a very respectable choice. ▲

—Craig Stinson



The Printed Word

by John Dickinson

MX-80 and IBM Graphics Printer: Are They Really the Same?

You've made your decision. It's the IBM Personal Computer. You've even decided which display to get, what kind of disk drives, how much memory you will need, and what brand of modem will suit you best.

Now, for a printer. You look at the models. "They all work with the pc," says the salesman. Good! So much for restricting our choices in life.

You look at the checkbook balance . . . better go for the less expensive matrix jobs. Say, there's a nice-looking gray one. "That's the IBM pc Graphics Printer," says the salesman. "It's made by Epson for IBM."

Epson? "Do they make one of their own?" you ask.

"Sure, the MX-80. The beige one right over here. It's got what they call 'Graftrax-Plus' on it. So does the IBM."

Graftrax? "What's that?"

"Oh, sort of a thing you do graphics—you know, pictures—with on your printer. Like I said, they both have that."

"It's funny, they look the same. Is it just the color, or am I missing something here?"

"Well, the IBM does have some soundproofing. See? It's here, under the cover. Keeps it quieter. And then, there's the price."

Price? The checkbook! "What're the prices?"

"Well, the IBM runs $595, and the Epson about $495. That's list, of course. Then there's the F/T option on the Epson; IBM won't sell you one."

"What's an F/T?"

"It's a thing that lets you use regular paper instead of that computer stuff if you want to."

"Oh. You mean like my company's letterhead?"

"Yeah. You can fit the Epson gadget on the IBM, but IBM says it voids their warranty. Course, the thing never breaks, so that's no big deal."

"What about the Epson. Does it ever break?"

"Nope. Built like the proverbial brick you-know-what. That's why IBM picked Epson to make their printer for them."

Now, what do you do? The printers look the same. They have the same features. The Epson seems to have more to offer with the F/T feature, and even with that option it's less expensive.

"Why would anyone spend the extra $100 for the IBM?" you ask.

"Well, it's got their name on it. If you have problems with IBM's software running another printer, they won't help you."

"But, you say that the Epson works okay. What kind of problems could I run into?"

"Hard to say. Look, all these printers work on the pc. But, IBM just supports theirs and the NEC, and little things could go wrong on you."

Are IBM's support and "little things" worth $100 to you? Could be. Let's take a look at what easily rates as the most confusing compatibility issue in the IBM-pc printer world: Are the Epson MX-80/Graftrax and the IBM Personal Computer Graphics Printer the same?

The easiest way to understand IBM's printer support is to look through your pc documentation. Wherever use of a printer is mentioned, the printer is always described as "the IBM Personal Computer Graphics Printer" or "the IBM Personal Computer Matrix Printer." The Matrix Printer is the earlier IBM model.

The documentation is quite specific. IBM makes a printer, and the pc and IBM-supported pc software work with it. When a feature of an IBM printer is no longer supported or does not correctly interface with the pc, that fact is documented. For example, the Basic Calendar demonstration program does not work correctly with the newer model IBM printer, and this is documented in the pc Graphics Printer manual. All other differences between the pc Matrix and Graphics printers are also well documented in the manual.

The documentation does not even acknowledge the NEC 3550 Printer that IBM distributes through its Product Centers. It certainly does not acknowledge the Epson MX-80! If you talk to an IBM representative about pc printers and ask about the Epson, you will most likely get a blank stare.

What about those "little things that could go wrong?" The things that can go wrong are all associated with printer features and options. Normal text printing will operate correctly on both printers. The accompanying table lists the major features and options of both printers. Differences between the printers will be highlighted in the rest of this article.

First, a few definitions and notes about the table.

If you're new to microcomputer printers, don't let the table's terminology or size frighten you. In the next few months we'll explain some of the more intricate and complex items for you. Hang in there. We'll be looking back at this table in future columns.

The terminology used in the table was derived from IBM and Epson printer documentation. The printer manuals usually list the features alphabetically by the *name* found in the first column of the table. One important enhancement made here is to divide the features into related functional areas. Each item is grouped with others that are in some way related. For example, all items having to do with line feeds and line spacing are grouped into the *vertical line feed control* functional area.

Here are a few definitions.

Name: This is the code name of the character combinations required to make the feature work.

Description: The description briefly tells you what the feature does.

Duration: The duration indicates how long the feature remains

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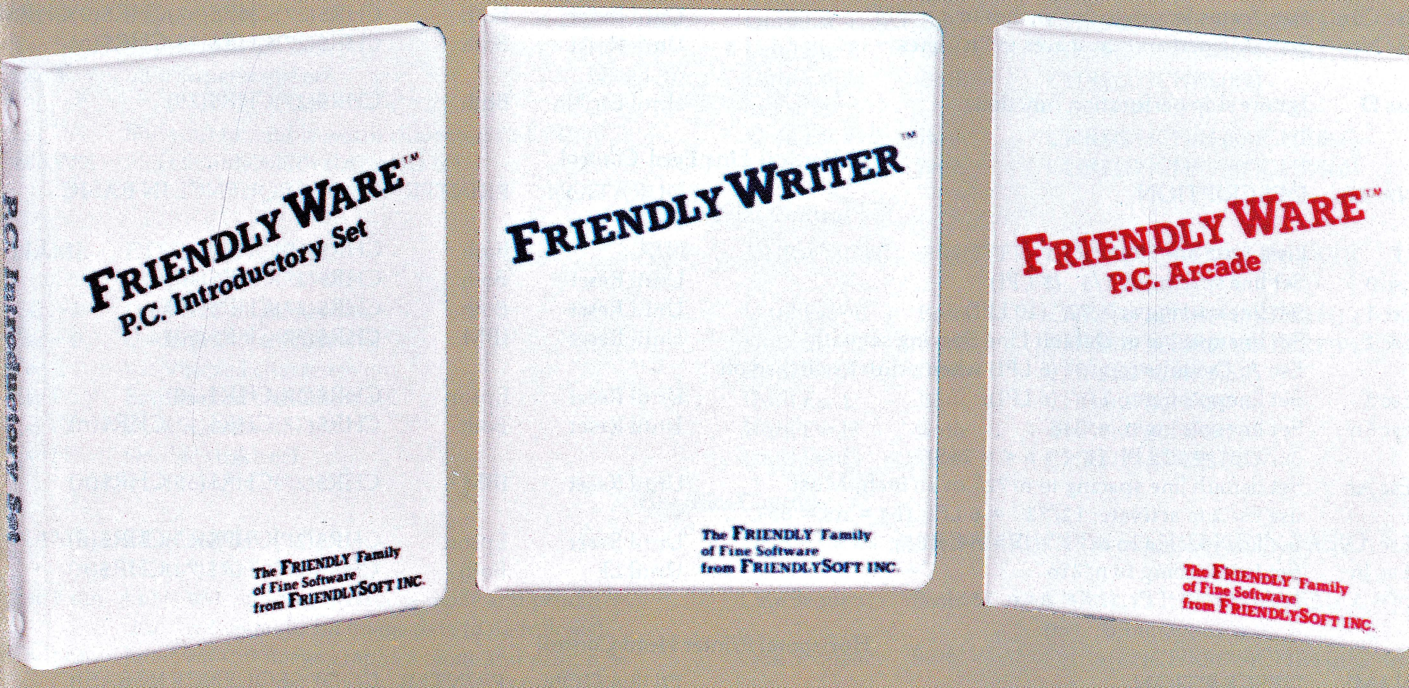
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IBM Graphics & Epson MX-80 Graftrax-Plus Printer Features Comparison Table

General Printer Control

NAME	DESCRIPTION	DURATION	PRINTER	CODE SEQUENCE IN BASIC
BEL	Sounds printer horn for one second.	N/A	Both	CHR$(7)
CAN	Clears printer buffer and cancels SO (see below).	N/A	IBM	CHR$(24)
Esc 4	Select Italic characters.	Until Esc 5	Epson	CHR$(27)CHR$(52)
Esc 5	Select normal characters.	Until Esc 4	Epson	CHR$(27)CHR$(53)
Esc 6	Select character set #2.	Until Esc 7	IBM	CHR$(27)CHR$(54)
Esc 7	Select character set #1 (default when printer turned on).	Until Esc 6	IBM	CHR$(27)CHR$(55)
Esc 8	Disable paper out switch/alarm.	Until Esc 9	Both	CHR$(27)CHR$(56)
Esc 9	Enable paper out switch/alarm.	Until Esc 8	Both	CHR$(27)CHR$(57)
Esc @	Reset printer to power-on condition.	N/A	Epson	CHR$(27)CHR$(64)

Forms Control

NAME	DESCRIPTION	DURATION	PRINTER	CODE SEQUENCE IN BASIC
FF	Go to top of next form.	N/A	Both	CHR$(12)
Esc Cn	Sets forms length to "n" lines (n < = 127).	Until Reset	Both	CHR$(27)CHR$(67)CHR$(n)
Esc C0n	Sets forms length to "n" inches (n < = 22).	Until Reset	Both	CHR$(27)CHR$(67)CHR$(0)CHR$(n)
Esc Nn	Sets skip perforation spaces to "n" lines.	Until Reset or Esc O	Both	CHR$(27)CHR$(78)CHR$(n)
Esc O	Ignore skip perforation function.	Until Esc Nn	Both	CHR$(27)CHR$(79)

Vertical Line Feed Control

NAME	DESCRIPTION	DURATION	PRINTER	CODE SEQUENCE IN BASIC
LF	Line feed one line.	N/A	Both	CHR$(10)
Esc 0	Set line spacing at 1/8" (8 LPI).	Until Reset	Both	CHR$(27)CHR$(48)
Esc 1	Set line spacing at 7/72" (10 LPI).	Until Reset	Both	CHR$(27)CHR$(49)
Esc 2	Set line spacing at Default Line Spacing set with Esc A. Defaults to 1/6" (6 LPI) when printer switched on.	Until Reset	IBM	CHR$(27)CHR$(50)
Esc 2	Set line spacing to 1/6" (6 LPI).	Until Reset	Epson	CHR$(27)CHR$(50)
Esc 3n	Set line spacing to n/216"; 36/216" = 12 LPI; (1 <= n <= 255).	Until Reset	Both	CHR$(27)CHR$(51)CHR$(n)
Esc An	Set default line spacing to n/72" of an inch; Must use Esc 2 to activate; 12/72" = 6 LPI; (1< = n<= 85).	Until Reset	IBM	CHR$(27)CHR$(65)CHR$(n)
Esc An	Set line spacing to n/72";(1<= n<= 85).	Until Reset	Epson	CHR$(27)CHR$(65)CHR$(n)
Esc Jn	Set line spacing to n/216"; 36/216" =6 LPI; (1<= n<= 255).	Until LF	Both	CHR$(27)CHR$(74)CHR$(n)

Horizontal Printer Head Control

NAME	DESCRIPTION	DURATION	PRINTER	CODE SEQUENCE IN BASIC
HT	Move head one horizontal tab stop (see Esc Dnn).	N/A	Both	CHR$(9)
CR	Ends line, prints remaining buffer.	N/A	Both	CHR$(13)
BS	One back space.	N/A	Epson	CHR$(8)

in effect after it has been enabled. This can be important to know for some applications using certain features. N/A in this column usually indicates that something occurs just once (for example, the horn sounds or the printer performs a form feed).

Printer: This indicates which printer the feature is available for—the IBM, the Epson, or both.

Code sequence in Basic: This is the control code sequence (in Basic's *chr$* notation) that activates the feature. The numbers in parentheses indicate the ASCII character number. The sequences translate easily to Pascal, assembler, or other languages. Printer option code sequences for some software packages can also be derived from these sequences, but you may have to convert them to hexadecimal.

You may become confused by seeing two features listed with the same name. The double listing indicates that two similar features operate differently in the IBM and Epson models.

The IBM and Epson are both very capable printing machines. There are over forty features listed for the two printers, and almost all of them are the same on both machines. For example, all the font and density controls are identical, and these are two of the most important features of matrix printers.

What are the differences? Basically they are:

Reset printer (escape-@): The MX-80 has this code—which sets

Esc <	Home head to left margin. Print left to right for one line.	N/A	Both	CHR$(27)CHR$(60)
Esc Dnn	Sets horizontal tabs at n1,n2...nk; (1 <= k <= 112 for Matrix and 1 <= k <= 28 for Graphics; 1< = n< = 132). Note CHR$(0) terminator.	Until Reset	Both	CHR$(27)CHR$(68)CHR$(n1)... .. CHR$(nk)CHR$(0)
Esc Qn	Set right margin to nth column.	Until Reset	Epson	CHR$(27)CHR$(81)CHR$(n)
Esc U1	Set printing to unidirectional.	Until Esc U0	Both	CHR$(27)CHR$(85)CHR$(1)
Esc U0	Set printing to bidirectional (default when printer on).	Until Esc U1	Both	CHR$(27)CHR$(85)CHR$(0)

Character Font Control

NAME	DESCRIPTION	DURATION	PRINTER	CODE SEQUENCE IN BASIC
SO	Shift out to double width characters (5 CPI).	Until LF or DC4	Both	CHR$(14)
SI	Shift in to compressed width characters (16.5 CPI). Combine with SO or Esc W1 for compressed-wide (8.25 CPI).	Until DC2	Both	CHR$(15)
DC2	Shift compressed width characters off.	Until SI	Both	CHR$(18)
DC4	Shift double width characters off.	Until SO	Both	CHR$(20)
Esc S1	Subscript on.	Until Esc T	Both	CHR$(27)CHR$(83)CHR$(1)
Esc S0	Superscript on.	Until Esc T	Both	CHR$(27)CHR$(83)CHR$(0)
Esc T	Sub/Superscript off.	Until Esc S1 or Esc S0	Both	CHR$(27)CHR$(84)
Esc W1	Shift out to double width characters (5 CPI).	Until Esc W0	Both	CHR$(27)CHR$(87)CHR$(1)
Esc W0	Shift double width characters off.	Until Esc W1	Both	CHR$(27)CHR$(87)CHR$(0)

Character Print Control

NAME	DESCRIPTION	DURATION	PRINTER	CODE SEQUENCE IN BASIC
Esc −1	Underline characters on.	Until Esc−0	Both	CHR$(27)CHR$(45)CHR$(1)
Esc −0	Underline characters off.	Until Esc−1	Both	CHR$(27)CHR$(45)CHR$(0)
Esc E	Emphasized characters on.	Until Esc F	Both	CHR$(27)CHR$(69)
Esc F	Emphasized characters off.	Until Esc E	Both	CHR$(27)CHR$(70)
Esc G	Double strike on.	Until Esc H	Both	CHR$(27)CHR$(71)
Esc H	Double strike off.	Until Esc G	Both	CHR$(27)CHR$(72)

Graphics Control

NAME	DESCRIPTION	DURATION	PRINTER	CODE SEQUENCE IN BASIC
Esc Knm	Enter 480-bit image graphics mode and print n + (256 * m) bytes of bit image data (data follows).	One Sequence	Both	CHR$(27)CHR$(75)CHR$(n)CHR$ (m)... bit image data
Esc Lnm	Enter 960-bit image graphics mode and print n + (256 * m) bytes of bit image data (data follows).	One Sequence	Both	CHR$(27)CHR$(76)CHR$(n)CHR$ (m)... bit image data
Esc Ynm	Enter 960-bit image graphics mode and print n + (256 * m) bytes of bit image data (data follows).	One Sequence	IBM	CHR$(27)CHR$(89)CHR$(n)CHR$ (m)... bit image data
Esc Znm	Enter 1920-bit image graphics mode and print n + (256 * m) bytes of bit image data (data follows).	One Sequence	IBM	CHR$(27)CHR$(90)CHR$(n)CHR$ (m)... bit image data

the printer to its "power-on" condition, including setting the top-of-form spot to the current position. The IBM does not have such a feature. To achieve the same result on the IBM, you have to switch the power off and then on again.

Set right column (escape-Q): The MX-80 allows control of the right margin. This code is more useful for users of the Epson MX-100, the MX-80's wide-carriage twin. The IBM does not have this feature.

Cancel buffer (CAN): The IBM allows the user to cancel the line in the printer's buffer without actually printing it. The MX-80 does not allow this.

Italic characters (escape-4 and escape-5): The MX-80 has a full italic character set that can be used in place of the normal one. The IBM does not have italic characters. The corresponding space in the IBM printer's set is occupied by text graphics and international characters.

Alternate character sets (escape-6 and escape-7): The IBM has two sets of characters in the ASCII 128−159 range. The first is a repeat of ASCII control characters 0 through 31; the second, a mix of international characters.

Backspace (BS): The MX-80 has a backspace (cancel previous character). The IBM does not include this feature.

Variable line spacing (escape-2, escape-A, escape-3, escape-J): Both printers allow you to vary the space between lines. Spacing is specified in 72nds or 216ths of an inch. Setting variable line spacing in 216ths of an inch (escape-3 and escape-J) works the same on the IBM and the Epson. However, there is a subtle difference between the printers in how the 72nds-of-an-inch option operates.

When the user specifies 72nds of an inch (using escape-2) on the MX-80, the command takes effect immediately. When the same code, escape-2, is used on the IBM, it also specifies 72nds of an inch, but the command does not take effect until it is enabled, by means of escape-A.

The Epson uses escape-A to set line spacing to one-sixth of an inch. You can set spacing to one-sixth of an inch on the IBM by specifying 12/72nds of an inch with escape-2, and then using escape-A.

The MX-80 has some additional general printer controls that are for non-IBM computers that send seven bits (instead of eight) to the printer. These may be ignored by pc users.

The most significant difference between the IBM and Epson printers is not directly addressed in our table; there just isn't space in the magazine to do it. The character sets outside the normal ASCII range of printable characters (see last month's column) are different.

The Epson printer has a full italic character set in the extended ASCII range (above ASCII 127). You can use it by directly addressing the characters. Just add 128 to the ASCII position for the normal character. The normal *A* is ASCII character 65; the italic *A* is ASCII character 193. You can also use the italic set by enabling it with escape-4; if you do that, your normal text will be printed with italic characters. There are also some international and text graphics characters in ASCII range 129 through 159.

The IBM has a mixed bag of text graphics and international characters in the extended ASCII characters above 127. The characters from ASCII 128 through 169 may be used either as a second set of control characters (the same as ASCII 0 through 31) or as international characters. The first use is enabled with character set number 1, the second with character set number 2 (see escape-6 and escape-7 in the table).

The text graphics characters are the problem.

Many packages written for the IBM pc use the lines and corners that IBM defined for ASCII characters 176 through 233 to make attractive screen displays. If you want to dump one of these screens to your printer with the printscreen key and have it look as attractive as the original, you must have the IBM pc Graphics Printer! If you use the Epson MX-80 you will get italic letters instead of lines and corners—and that's probably not what you're looking for.

The Epson actually does have similar lines and corners. Your own program could easily use them (they're in ASCII characters 149 through 159). However, they are in the wrong positions for the IBM (but the right ones for Epson's own HX-20 computer).

Even if the Epson characters were in the correct positions, they would not produce the same results as the IBM text graphics characters. The method IBM used to implement the characters uses the graphics capability of the printer. A normally produced matrix character occupies eight dots vertically. The IBM text graphics characters are twelve dots high, which allows them to fill the vertical space between lines. This can only be done in the printer's graphics mode. The Epson characters are normally produced and leave spaces between the lines.

There are some additional differences in the graphics capabilities (escape-K, escape-L, escape-Y, and escape-Z) of the two printers. We'll save these for a column about printer graphics in general. ▲

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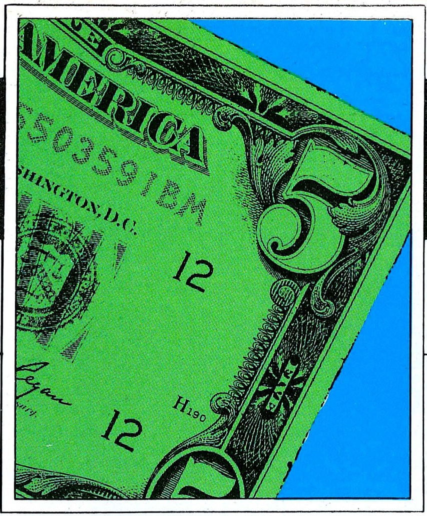


THE PROFIT PLOT

by Jack Grushcow

A Payroll Deduction Worksheet

Before we get into the payroll application, we'd like to conduct a brief survey. We are preparing a detailed article on how to increase spreadsheet reliability. We'd like to know how you ensure that your spreadsheets give you the correct results. Have you ever been caught presenting incorrect results? What areas, if any, worry you about using spreadsheets?

If you have a moment, drop a line to Jack Grushcow, in care of *Softalk for the IBM Personal Computer*, Box 60, North Hollywood, CA 91603. We'd like to hear from you. Your responses can help others get more reliable results with their spreadsheets.

The last two articles dealt with the use of Lookup, Choose, and the logic functions. This month we'll apply some of these functions to create a payroll worksheet.

If payroll calculation is not at the top of your application list, you can still gain from following our example.

Payroll is an example of a multistep spreadsheet application. Many of the techniques we'll use here can be used later to solve other complex problems. These methods include problem definition, structured spreadsheet layout, and complex formula entry.

Since the payroll tax rules read like the instructions for Monopoly, they're ideal for our purpose. Approach the section that follows with a light heart and remember—we could be describing any of the hundreds of complex applications that you would like to tackle with your spreadsheet program. By following this exercise you'll be better equipped to handle those other applications.

Divide and Conquer. There are three basic deductions used in the United States. These are state income tax, Social Security (FICA), and last (but definitely not least) federal withholding tax (FWT). We'll analyze each of these taxes in detail and then see how we can construct a spreadsheet to calculate the correct payroll deduction for each.

Our first step is to divide the large problem into component parts. This will make the entire system easier to design. So we have selected the three different classes of payroll deduction as the building blocks of our system.

State Income Tax. The states that tax employee wages apply a specific rate of tax to the wages earned. Wages, in this case, means annual wages less certain allowances that may reduce the annual taxable income.

In order for our payroll system to be more flexible, we'll use the annualized method of calculating taxes. This will allow you to use any pay period you like.

To calculate state taxes, we'll need several pieces of information. The first is the number of pay periods used. Pay periods are usually weekly or biweekly but may be monthly, quarterly, or of any other duration.

Once we know the pay period we can calculate annualized wage. The annualized wage is the pay for the pay period multiplied by the number of periods per year.

For example, suppose you pay your employees weekly. If an employee's gross pay per week is $540, then that employee's annualized pay is:

weekly wage * number of pay periods
= 540 * 52
= 28,080

In order to find how much of the employee's gross wage represents taxable income, we need to deduct the number of allowances the employee is entitled to. These allowances represent exemptions from certain portions of income. Because allowances apply to annual earnings, we need first to calculate the annual earnings (as we did in the previous step) and then subtract the allowances.

To find out how many allowances an employee is entitled to, we first need to check the employee's W-4 form. If no special exemptions are claimed on that form, then the employee is entitled to one allowance.

Each allowance claimed reduces the annual taxable income by some amount. Assuming for the moment that that amount is $1,000, our example calculation for the employee's taxable income looks like this:

annualized wage − allowances * 1,000)
= 28,080 − (1 * 1,000)
= 27,080

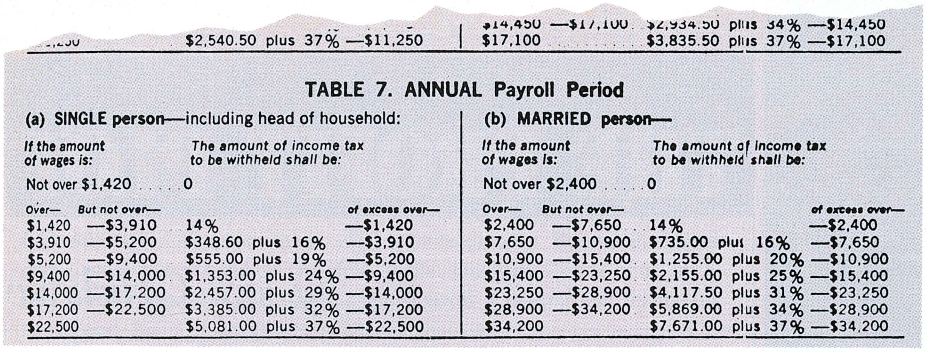
Now that we have the taxable income, we need to know what state tax rate to apply. Once we have this percentage and apply it to the annual wage, we'll need to divide the result by the number of pay periods per annum. This will turn the annual state income tax deduction into the deduction per pay period.

Suppose the applicable state tax rate is 2.5 percent. Then the final formula that gives us our state tax deduction per pay period is:

(taxable income * tax rate) / number of pay periods
= (27,080 * .025) /52
= 677 / 52
= 13.02

Let's take a moment now to summarize the steps taken to calculate state tax. Do not pass GO before you read this summary.

1. Determine the pay period.
2. Calculate annualized pay by multiplying the pay per period times the number of periods per year.
3. Calculate the annual taxable income by subtracting the state allowances from the annual pay.
4. Apply state tax to the annual income, then divide the result by the number of pay periods per year to get the deduction per pay period.



		$2,540.50 plus 37%	—$11,250	$14,450	—$17,100	$2,934.50 plus 34%	—$14,450
				$17,100		$3,835.50 plus 37%	—$17,100

TABLE 7. ANNUAL Payroll Period

(a) **SINGLE person**—including head of household:

If the amount of wages is: *The amount of income tax to be withheld shall be:*

Not over $1,420 0

Over—	*But not over—*		*of excess over—*
$1,420	—$3,910	14%	—$1,420
$3,910	—$5,200	$348.60 plus 16%	—$3,910
$5,200	—$9,400	$555.00 plus 19%	—$5,200
$9,400	—$14,000	$1,353.00 plus 24%	—$9,400
$14,000	—$17,200	$2,457.00 plus 29%	—$14,000
$17,200	—$22,500	$3,385.00 plus 32%	—$17,200
$22,500		$5,081.00 plus 37%	—$22,500

(b) **MARRIED person—**

If the amount of wages is: *The amount of income tax to be withheld shall be:*

Not over $2,400 0

Over—	*But not over—*		*of excess over—*
$2,400	—$7,650	14%	—$2,400
$7,650	—$10,900	$735.00 plus 16%	—$7,650
$10,900	—$15,400	$1,255.00 plus 20%	—$10,900
$15,400	—$23,250	$2,155.00 plus 25%	—$15,400
$23,250	—$28,900	$4,117.50 plus 31%	—$23,250
$28,900	—$34,200	$5,869.00 plus 34%	—$28,900
$34,200		$7,671.00 plus 37%	—$34,200

Figure 1.

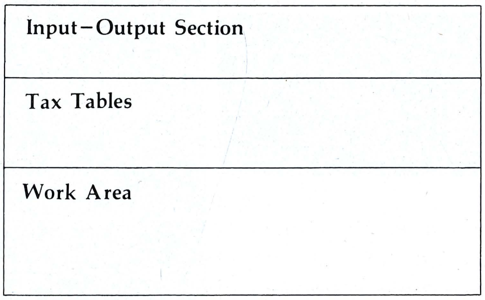


Figure 2.

Social Security Tax (FICA). This payroll deduction, which we all hope to spend in the sun at some future date, is the simplest of all the taxes to calculate. The employee contribution to Social Security is a percentage of the employee's gross wage. To calculate the FICA deduction, you multiply the gross wage by the appropriate FICA percentage.

Let's suppose the FICA rate is 6.7 percent and our employee earns $100 during the pay period. Then the FICA deduction for this period for this employee would be calculated as:

pay * FICA rate
= 100 * .067
= 6.70

This calculation forms the second piece of our three-part foundation.

Federal Withholding Tax. In addition to paying state tax and withholding Social Security tax, the employer must also withhold federal income tax from employee wages. Like an unwanted relative who visits too long, income tax has been with us ever since World War I, when it was introduced as a "temporary" measure.

The government reasons that tax should be deducted each time wages are paid, in order to prevent "the extreme financial hardship" an employee would suffer if he or she had to pay the entire year's tax shot in one large bite. Additionally, the government reasons that it would enjoy receiving regular contributions to its stream of revenues.

Calculation of the federal withholding tax, like that of state income tax, is a multistep process.

We'll be using the percentage method of income tax withholding. As in the case of state tax, to find the FWT you must first determine the annualized taxable income. To find that, follow the same steps that we took in the state tax example. Combining those steps, we arrive at the following formula for annualized taxable income:

(pay * number of periods per year) − allowances

Suppose we have an employee who claimed two allowances on her W-4 form. If this employee is paid biweekly and earns $1,200 in the current pay period, we'd calculate her annualized taxable income as follows:

(1,200 * 26) − 2,000
= 29,200

To find out how much to withhold, we turn to the government's form Circular E, the Employer's Tax Guide. Locate the section entitled "Tables of Percentage Method of Withholding." Here we'll find the tables we need to determine the tax.

Figure 1 is a copy of the appropriate section of Circular E. Since we're computing tax on an annualized basis, we select the table entitled Annual Payroll Period.

Once we know the annualized wage, we need to take two steps to find the withholding tax. First we look at the left side of the table to see which range the annual income falls into. This will tell us the

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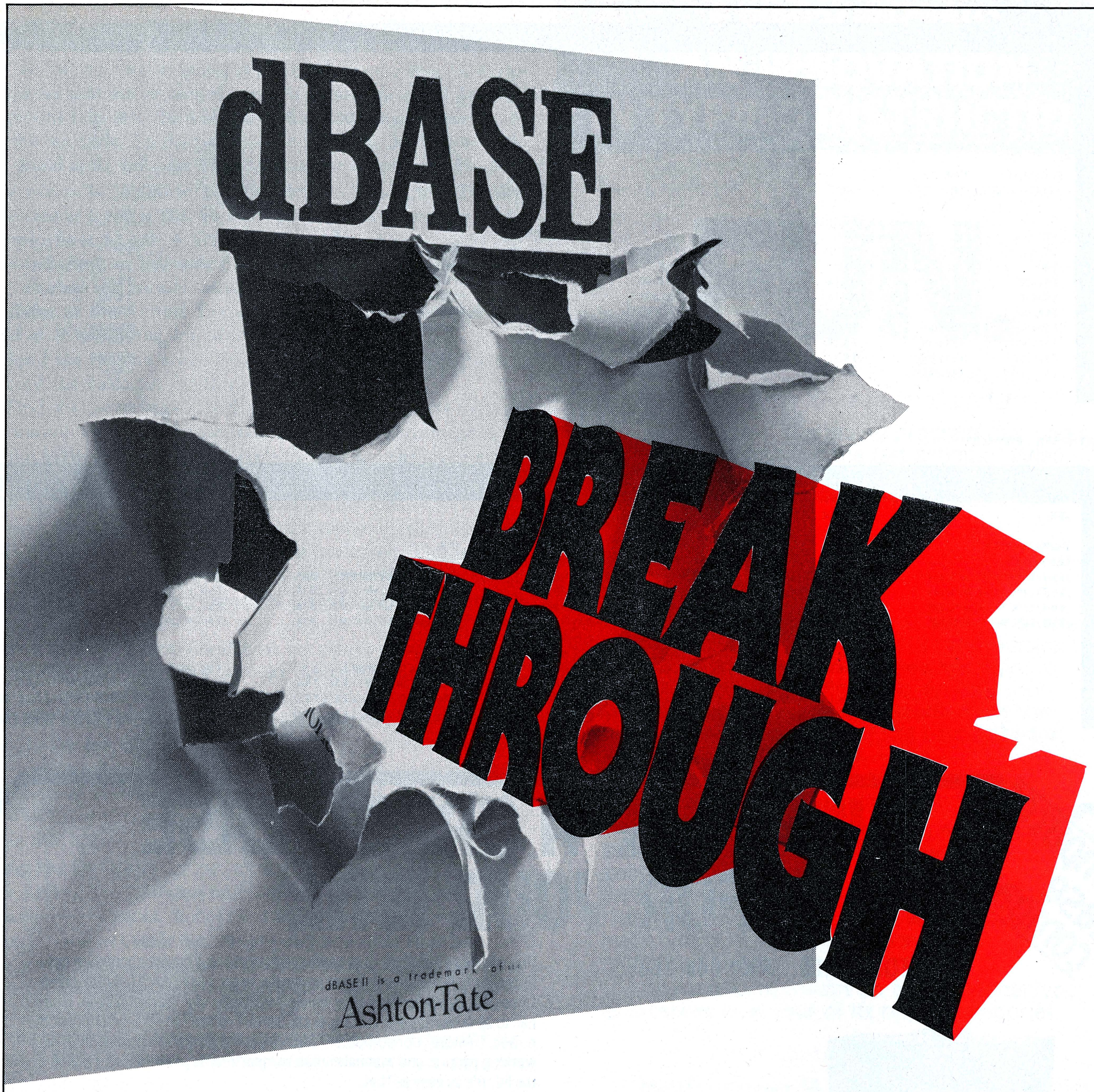

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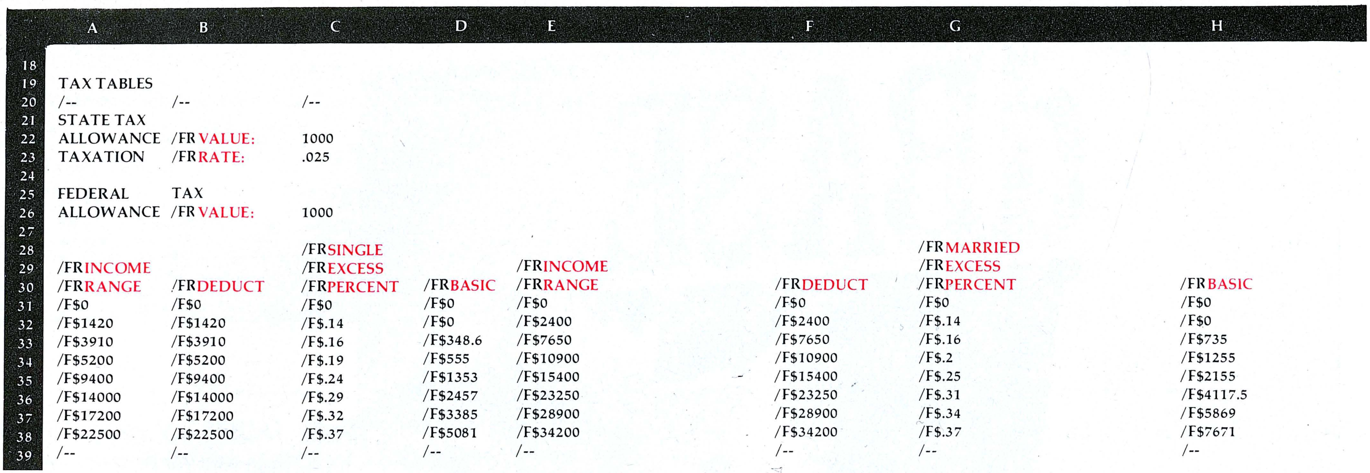
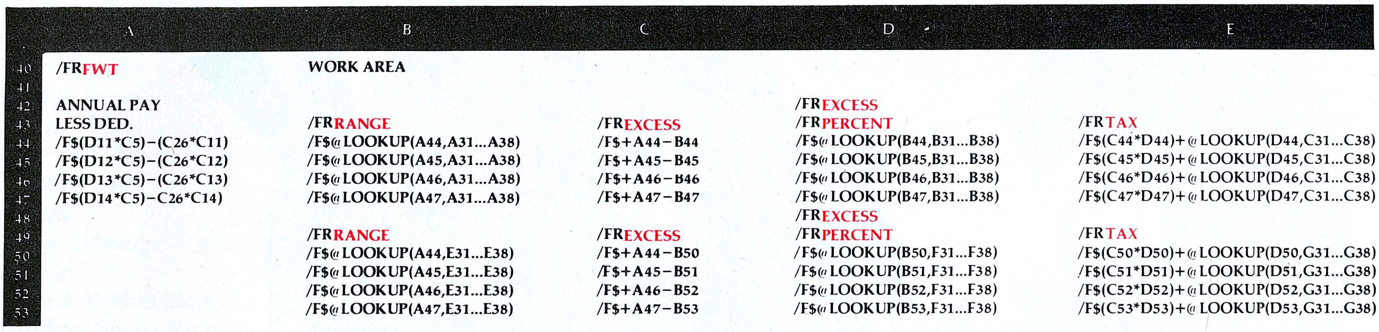


	A	B	C	D	E	F	G	H
18								
19	TAX TABLES							
20	/--	/--	/--					
21	STATE TAX							
22	ALLOWANCE	/FRVALUE:	1000					
23	TAXATION	/FRRATE:	.025					
24								
25	FEDERAL	TAX						
26	ALLOWANCE	/FRVALUE:	1000					
27								
28			/FRSINGLE				/FRMARRIED	
29	/FRINCOME		/FREXCESS		/FRINCOME		/FREXCESS	
30	/FRRANGE	/FRDEDUCT	/FRPERCENT	/FRBASIC	/FRRANGE	/FRDEDUCT	/FRPERCENT	/FRBASIC
31	/F$0	/F$0	/F$0	/F$0	/F$0	/F$0	/F$0	/F$0
32	/F$1420	/F$1420	/F$.14	/F$0	/F$2400	/F$2400	/F$.14	/F$0
33	/F$3910	/F$3910	/F$.16	/F$348.6	/F$7650	/F$7650	/F$.16	/F$735
34	/F$5200	/F$5200	/F$.19	/F$555	/F$10900	/F$10900	/F$.2	/F$1255
35	/F$9400	/F$9400	/F$.24	/F$1353	/F$15400	/F$15400	/F$.25	/F$2155
36	/F$14000	/F$14000	/F$.29	/F$2457	/F$23250	/F$23250	/F$.31	/F$4117.5
37	/F$17200	/F$17200	/F$.32	/F$3385	/F$28900	/F$28900	/F$.34	/F$5869
38	/F$22500	/F$22500	/F$.37	/F$5081	/F$34200	/F$34200	/F$.37	/F$7671
39	/--	/--	/--	/--	/--	/--	/--	/--

Figure 3.

FILE NAME: PAYROLL



	A	B	C	D	E
40	/FRFWT	WORK AREA			
41					
42	ANNUAL PAY			/FREXCESS	
43	LESS DED.	/FRRANGE	/FREXCESS	/FRPERCENT	/FRTAX
44	/F$(D11*C5)-(C26*C11)	/F$@LOOKUP(A44,A31...A38)	/F$+A44-B44	/F$@LOOKUP(B44,B31...B38)	/F$(C44*D44)+@LOOKUP(D44,C31...C38)
45	/F$(D12*C5)-(C26*C12)	/F$@LOOKUP(A45,A31...A38)	/F$+A45-B45	/F$@LOOKUP(B45,B31...B38)	/F$(C45*D45)+@LOOKUP(D45,C31...C38)
46	/F$(D13*C5)-(C26*C13)	/F$@LOOKUP(A46,A31...A38)	/F$+A46-B46	/F$@LOOKUP(B46,B31...B38)	/F$(C46*D46)+@LOOKUP(D46,C31...C38)
47	/F$(D14*C5)-C26*C14)	/F$@LOOKUP(A47,A31...A38)	/F$+A47-B47	/F$@LOOKUP(B47,B31...B38)	/F$(C47*D47)+@LOOKUP(D47,C31...C38)
48				/FREXCESS	
49		/FRRANGE	/FREXCESS	/FRPERCENT	/FRTAX
50		/F$@LOOKUP(A44,E31...E38)	/F$+A44-B50	/F$@LOOKUP(B50,F31...F38)	/F$(C50*D50)+@LOOKUP(D50,G31...G38)
51		/F$@LOOKUP(A45,E31...E38)	/F$+A45-B51	/F$@LOOKUP(B51,F31...F38)	/F$(C51*D51)+@LOOKUP(D51,G31...G38)
52		/F$@LOOKUP(A46,E31...E38)	/F$+A46-B52	/F$@LOOKUP(B52,F31...F38)	/F$(C52*D52)+@LOOKUP(D52,G31...G38)
53		/F$@LOOKUP(A47,E31...E38)	/F$+A47-B53	/F$@LOOKUP(B53,F31...F38)	/F$(C53*D53)+@LOOKUP(D53,G31...G38)

Figure 4.

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basic tax. Next we apply the percentage shown on the right of the income range to any excess over the lower end of the range. By applying this percentage to the excess and adding the result to the basic tax, we get the total annual FWT. Let's look at a specific example. Suppose that the employee's taxable annual income is $16,500. This amount falls into the $14,000-to-$17,200 range shown to the left of the tax table. To the right we find that the amount to withhold is equal to $2,457 plus 29 percent of the excess over $14,000.

The excess is 16,500 − 14,000, which equals 2,500. Twenty-nine percent of 2,500 is 725. So the total annual withholding tax for this employee is $2,457 + $725, or $3,182.

Summarizing, to calculate FWT we take the following steps:

1. Calculate the annual taxable income.
2. Refer to the Annual Payroll Period table of the Percentage Method of Withholding found in Circular E.
3. Find the income range that the annual income falls within and record the basic tax for this range.
4. Find the percentage rate that applies to any excess over the lower amount of the appropriate range, apply this percentage to the difference between the annual taxable income and the lower end of the range, and add the result to the amount arrived at in step 3.

This is the last of our three payroll calculations.

Spreadsheet Layout. We have now defined in detail the calculations we intend to perform on our payroll worksheet. This is the essential first step to building a complex worksheet. If you can't clearly define how to do a job on paper you'll never get it done correctly on an electronic spreadsheet.

Now let's draw a diagram of how we want our spreadsheet to look. Figure 2 (page 128) shows a rough design for this spreadsheet. This is a creative as well as analytical exercise. Some designs are more efficient than others, but there is almost always more than one way to get the job done. Be creative.

We have divided the model into three parts: an area for data input and output, an area to hold the tax tables, and a work area. We expect FWT calculation to take several steps, and therefore we've set aside this last section (the work area) as a kind of scratch pad.

Entering the Formulas

Tax Tables. We will start building our model by typing in the area marked Tax Tables. It's often a good idea to start work on a complex spreadsheet with the things you know. We start here, because it gives us the opportunity to enter the tax tables, as well as supplying information about the rate of state tax (if any) and the allowance values for state and federal tax.

At the top of this section you enter the allowance value and percentage for state tax. If your state applies no tax, then you can leave cells C22 and C23 blank.

Below this area, enter the federal allowance value. This value is shown in Circular E.

Next we've entered the tax tables for both married and single employees. We have used the information from Circular E from the Percentage Method of Withholding.

We'll use the Lookup function to calculate the withholding amount. Because of the way this function works, the tax tables need to be modified. We have added an initial range of zero dollars to the first line of the tables. This allows the lower end of the first income range to be selected by Lookup (see last month's column for more details on the use and workings of Lookup and Choose).

The income range and deduct columns hold the same numbers because the Lookup function in *VisiCalc* and *SuperCalc* cannot select the index column as the result of the Lookup argument (this extra column would not be necessary in *1-2-3*).

With the tables for both married and single employees entered, we're ready to take the next step in building the payroll model.

Work Area. The next section we'll examine is the FWT work area. It's here that we will calculate some intermediate results so that later calculations will be simplified.

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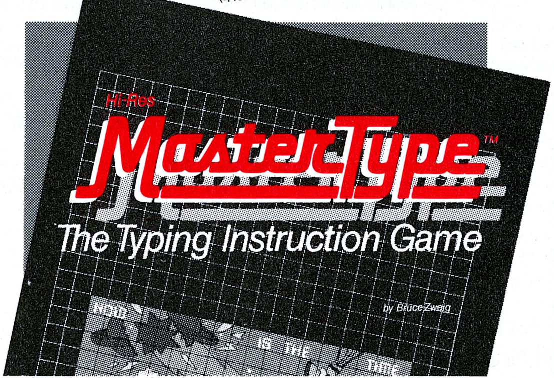

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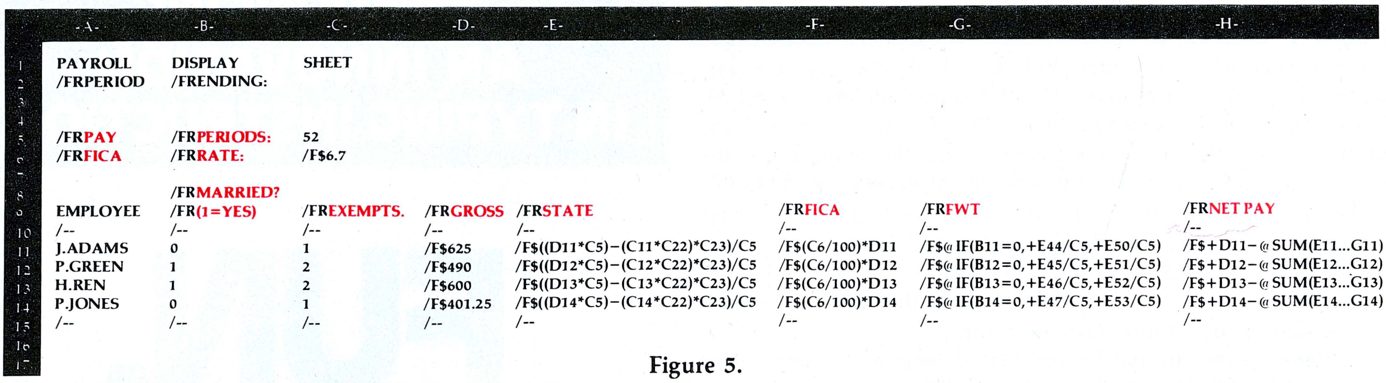

	-A-	-B-	-C-	-D-	-E-	-F-	-G-	-H-
1	PAYROLL	DISPLAY	SHEET					
2	/FRPERIOD	/FRENDING:						
3								
4								
5	/FRPAY	/FRPERIODS:	52					
6	/FRFICA	/FRRATE:	/F$6.7					
7								
8		/FRMARRIED?						
9	EMPLOYEE	/FR(1=YES)	/FREXEMPTS.	/FRGROSS	/FRSTATE	/FRFICA	/FRFWT	/FRNET PAY
10	/--	/--	/--	/--	/--	/--	/--	/--
11	J.ADAMS	0	1	/F$625	/F$((D11*C5)−(C11*C22)*C23)/C5	/F$(C6/100)*D11	/F$@IF(B11=0,+E44/C5,+E50/C5)	/F$+D11−@SUM(E11...G11)
12	P.GREEN	1	2	/F$490	/F$((D12*C5)−(C12*C22)*C23)/C5	/F$(C6/100)*D12	/F$@IF(B12=0,+E45/C5,+E51/C5)	/F$+D12−@SUM(E12...G12)
13	H.REN	1	2	/F$600	/F$((D13*C5)−(C13*C22)*C23)/C5	/F$(C6/100)*D13	/F$@IF(B13=0,+E46/C5,+E52/C5)	/F$+D13−@SUM(E13...G13)
14	P.JONES	0	1	/F$401.25	/F$((D14*C5)−(C14*C22)*C23)/C5	/F$(C6/100)*D14	/F$@IF(B14=0,+E47/C5,+E53/C5)	/F$+D14−@SUM(E14...G14)
15	/--	/--	/--	/--	/--	/--	/--	/--
16								
17								

Figure 5.

The FWT calculation takes several steps. First, we have to determine the annualized taxable income. The formulas at A44 through A47 do this for each of four employees. The annualized income is calculated, and then the allowances are deducted.

When we know the income, we can see what range the income falls into; then we can calculate the excess above the low end of that range. The formulas at B44 through B47 match the taxable earnings against the income range and select the amount to deduct for the excess calculation.

The formulas at C44 through C47 calculate the excess of earnings over the lower limit in the table. This is the amount to which we'll apply the excess tax percentage.

We need to find the correct percentage tax to apply to that excess. The result of the excess calculation, in column C, becomes the index to the Lookup formulas found in D44 through D47. These formulas display the excess tax percentage.

Now we're in a position to calculate the annual taxes to be paid by a single employee. To get that figure, we add the excess percentage to the basic tax. The result appears in E44 through E47.

These same calculations are repeated in the section below this one to calculate the FWT for married employees.

Now we have all the raw information we need. All that's left to do are a few summing-up calculations.

Input/Output Section. The final section of our spreadsheet is shown in figure 5. Just as we entered the tax data earlier, we'll now enter information about our employees and our pay periods.

You can use cell C2 to enter the period-ending information. This is optional; if you use it, it will help you verify the correctness of your payroll sheet.

Location C5 is crucial to the correct operation of this spreadsheet. Enter the number of pay periods in a calendar year here. Weekly pay means fifty-two periods, biweekly twenty-six, and so on.

The Social Security tax, or FICA, rate goes in cell C6. You can find this rate in the always helpful Circular E; it's usually right at the beginning of the document.

Following the FICA rate, enter each employee name along with marital status and number of claimed exemptions. This data goes in columns A through C, starting at row 11. The employee information should change only once a year.

The next column, which contains the gross pay, may change each pay period. When all the formulas are in place, you need only enter the gross pay in column D, and the deductions will be displayed individually in the following four columns.

The state income tax is calculated by application of the state tax rate to the annual taxable income, divided by the number of periods. The formulas to do this are found in column E.

The FICA tax calculation is the simplest; just take the FICA percentage and apply it to the gross earnings. Formulas for FICA are in column F.

The federal withholding tax deduction is displayed in column G. To understand how this number is arrived at, refer back to the FWT work area.

We have to make two adjustments to the figures in the work area. First we have to select either the single or married FWT. Next, since we calculated the annualized tax, we have to convert this figure back to its pay-period equivalent, by dividing the annual tax by the number of pay periods.

Finally, we get to net pay. This figure is simply the gross pay minus the sum of the deductions. Our spreadsheet displays net pay in column H.

Figure 6 shows the input/output section of our spreadsheet as it appears after the calculations have been done. ▲

```
      PAYROLL DISPLAY  SHEET
       PERIOD ENDING:

         PAY PERIODS:            52
           FICA RATE:          6.70

            MARRIED?
EMPLOYEE    (1=YES)   EXEMPTS.   GROSS    STATE    FICA     FWT   NET PAY

J.ADAMS           0          1  625.00    15.14   41.88  160.54    407.44
P.GREEN           1          2  490.00    11.29   32.83   80.55    365.33
H.REN             1          2  600.00    14.04   40.20  114.83    430.93
P.JONES           0          1  401.25     9.55   26.88   81.50    283.32
```

Figure 6.

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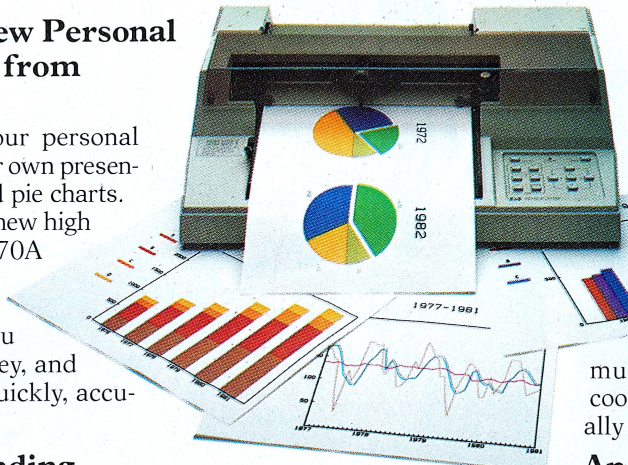

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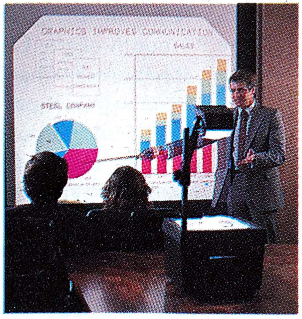

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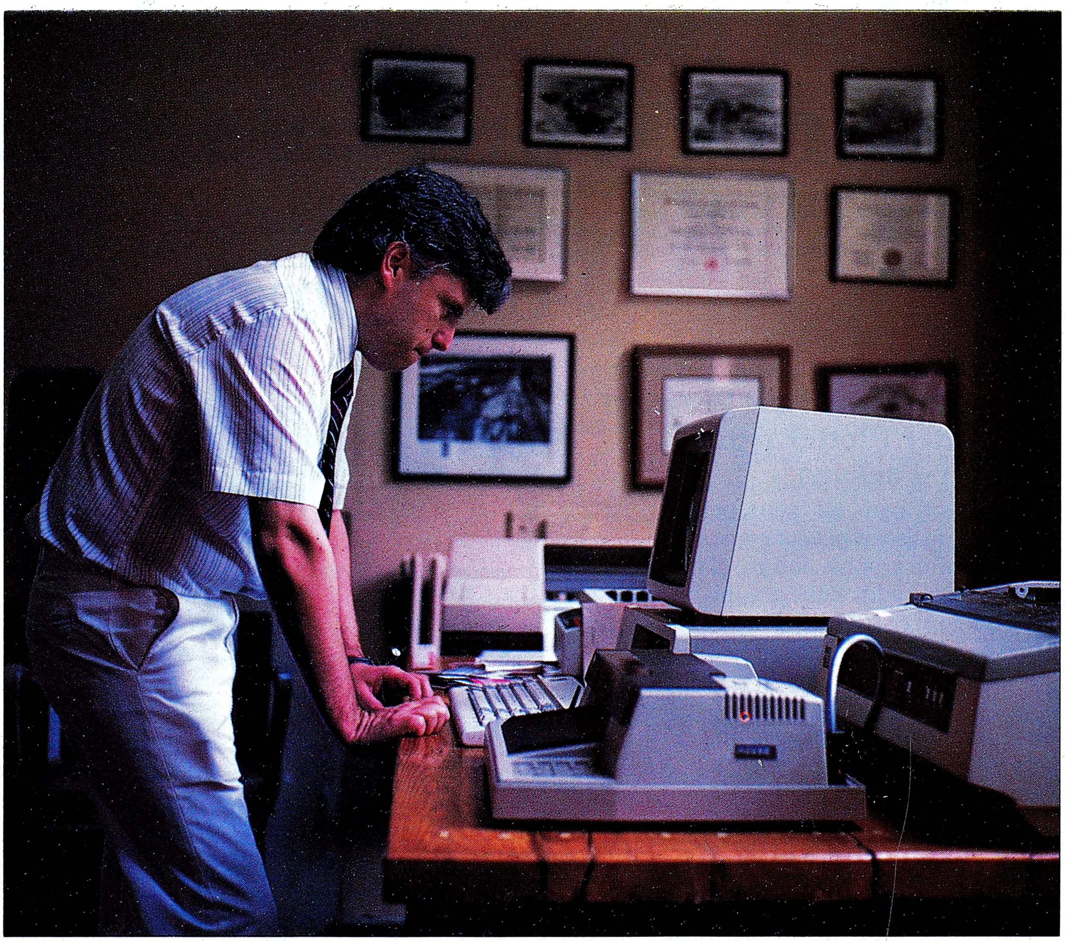

The Dutch have been fighting the North Sea for more than six hundred years. Half of the Netherlands is built on land reclaimed from the sea and is below sea level. A huge system of dikes keeps the countryside dry.

Under construction right now is a multibillion-dollar structure called the Oosterschelde Storm Surge Barrier, a concrete wall designed to protect the southeastern coast of Holland from flooding by storms from the North Sea.

The scale of the project is awe-inspiring. "Imagine building a barrier beneath the Golden Gate Bridge from one side to the other to prevent large storm waves from sweeping in from the Pacific Ocean to the San Francisco Bay," says Dr. Allen Marr, a consulting geotechnical engineer who worked on the design phase of the huge project.

The barrier promised to be a daring, demanding, and complicated project when it was proposed twenty-five years ago. The design has involved extensive use of large-scale model testing and advanced computer analysis.

As a member of the board of consultants for the project, Marr relied on a mainframe to determine whether the wall's foundation would remain stable and intact when subjected to forces from the water. He also used the computer in conducting engineering analysis to predict whether the structure would stay safe over time.

"In effect, the cassion is a dam across the mouth of the Oosterschelde bay with large gates that close when a storm is coming out of the North Sea. It protects the bay from big waves and high tides," he explains.

A computer was used in the performance of complex analysis that showed how the foundation would behave when cyclic wave loads were beating up against it.

"It's a complicated problem," says Marr. "One thousand waves during a storm means the wall is stressed one thousand times. We tested a physical model one-third the size of individual elements in the final structure. We had over one hundred instruments located throughout the model; they were loaded cyclicly by simulated wave motion as fast as three or four cycles per second. A minicomputer took twenty to thirty readings of each instrument per cycle, and the information was stored for later evaluation."

Elaborate computer models were created to analyze the wave pulses, and these programs were used to predict the behavior of the model and determine the long-term stability of the structure.

Analysis of the sort just described has traditionally been done on mainframes and minicomputers. Now microcomputers are getting into the act.

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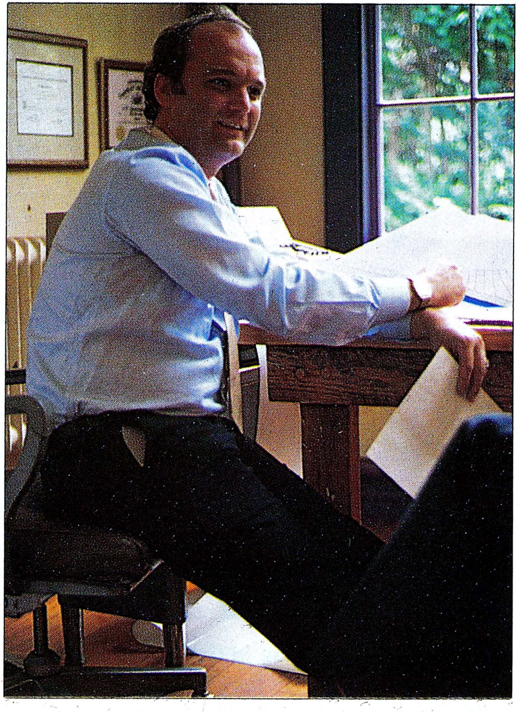


civil engineering office looks to be the IBM Personal Computer. And, if software trends continue, more engineers will be trading Fortran for Pascal and Basic.

Dr. Marr (he prefers to drop the title in more informal situations) was called in during the design phase of the storm surge barrier project and is not involved in the actual construction. He has since moved on to other consulting jobs in other parts of the world.

One of those new consulting challenges was offered him by Toa Nenryo Kogyo, the third largest oil company in Japan. The sixty-foot-high oil tanks at this company's refinery are sinking into the ground, having settled twelve feet over the last fifteen years.

Now, contrary to what you might imagine, a sinking tank is not a problem "if it's settling uniformly," says Marr. But if tanks start to settle out of plane—that is, if one area of a tank starts sinking faster than another—then there's going to be trouble.

As part of a team of specialists, Marr has been flying to Japan for one week a year over the last six years. Measurements from 144 points along the bottom of each tank are taken each year, and Marr brings the information home for analysis.

Until last year, data was fed into a mainframe to determine whether a tank was settling uniformly or out of plane. Then, using a contour picture drawn on a plotter, Marr evaluated the results.

From now on, things won't have to be done quite that way. Marr will still go to Japan, but now he can Telex the information back to his home office in Concord, Massachusetts, where a pc acts as a terminal. There his partner, Dr. Alfredo Urzua, will analyze the data (also on the pc), using a Basic program down-scaled from a mainframe version written in Fortran. *GeoContour*, another special program Urzua has written, will be used to plot the contour map of the results.

From Mainframes to Micros. The switch to the pc came about last year when Marr, in partnership with Urzua, formed Geocomp, a consulting firm that provides practicing engineers with computer technology useful in their daily work.

One of the advantages Geocomp has over its competition is its extensive use of the micro. Both Urzua and Marr are convinced that the Personal Computer makes a valuable silent partner.

At home and on the road: Alfredo Urzua (opposite page) and Allen Marr (above, left) use the pc at the Concord, Massachusetts, office of Geocomp, their geotechnical engineering consulting firm. Left, a site in Japan, where computer technology provided the information needed to "dig a square hole"; below, a location closer to home—an experiment involving the collapse of a Revere, Massachusetts highway embankment.

Marr and Urzua met at MIT in 1976. Marr was a research associate and spent most of his time teaching. "I loved consulting too much to be a full-time professor," he says. Eventually the research in which he was involved at the university lost its luster, and Marr took up consulting full-time.

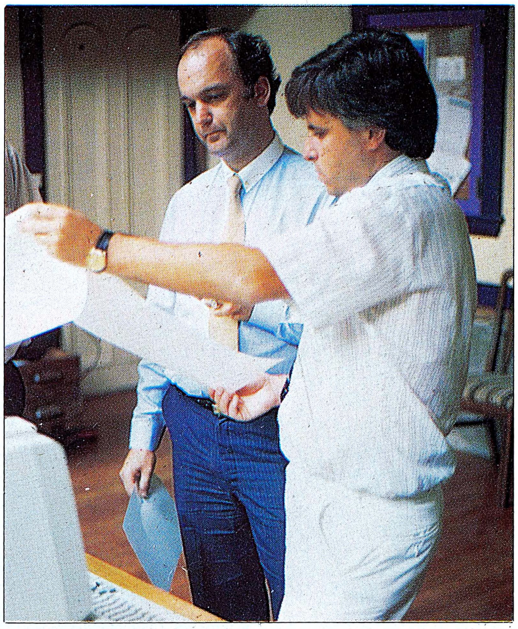
Urzua taught at a university in his native Chile and also at the National University of Colombia before undertaking doctoral work at MIT. The Netherlands project was the subject of his

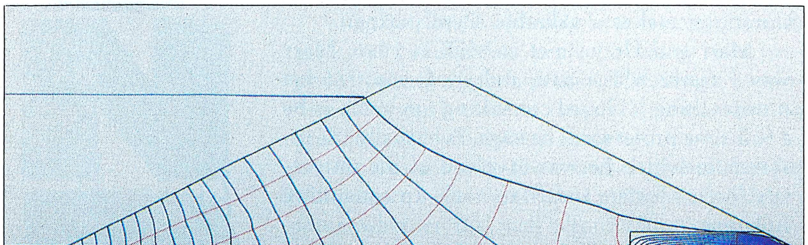
by
Michael
Ferris

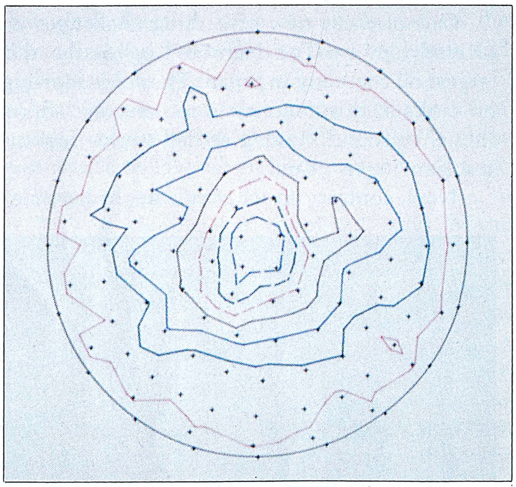
dissertation, and it was only natural that he should choose Marr as his thesis adviser.

The firm founded by Urzua and Marr offers a contrasting set of specialties. Marr focuses on the physical behavior of engineering materials, while Urzua concentrates on computer modeling. The company performs analysis for other engineers and provides turnkey systems and other software to be used in analysis and data collection.

''Allen is an expert in static behavior of facilities,'' says Urzua. ''He can look at putting up a building as a static problem. My slice of the pie, because of my background, is to look at more dynamic problems, such as what is going to happen to a building and soil if you shake it during an earthquake.''







Above, left: Sheet piling modeled by computer was used in the construction of a wall around a building excavation; computer modeling enabled Geocomp to help prevent a city's streets from falling in. Above, right: Marr reviews the results of a water-flow analysis. Below, left: an earthen dam plot showing the flow of water in blue. Below, right: a plot for one of the Japanese refinery tanks, showing the surveyed points.

It shakes a lot where Urzue comes from—about once a month. He was living in Chile at the time of the 1960 quake, one of the largest seismic upheavals of recorded time.

Fittingly, as part of the Japanese oil tank project, Urzua performed several seismic risk assessments and dynamic analysis of the area—using his pc. A civil engineering classic called *Shake* calculated stresses.

''*Shake* models the soil beneath a tank,'' explains Marr. ''It starts with an estimate of the size of an earthquake you think might typically occur at a site. You scale it and use it as your design quake, or input motion. The program looks to see what happens to that motion as it comes up from deep in the ground.''

The pc took over toward the end of another consulting project, again in Japan, for Kawasaki Steel. ''We were trying to find a way to dig holes under cities and support them so the streets didn't fall in,'' explains Marr.

''In a crowded city you can't dig and use gradual slopes like in a highway cut. It takes up too much space. And if you just dig out vertical faces in the soil, at some point you're going to have massive soil failures and the streets will fall in on you.

''What we did was put a wall around the perimeter of square excavation for a building. The walls were made out of sheet piling, a strong material. We needed a way to support this sheeting and keep it from deforming under pressure from the dirt behind it.''

A model of the sheet piling was programmed on a Hewlett-Packard mini installed at the site. ''Kawasaki was working in real time on forecasting procedures to avert the failure of the wall, with instruments connected to the computer measuring soil movements and stresses on the wall.''

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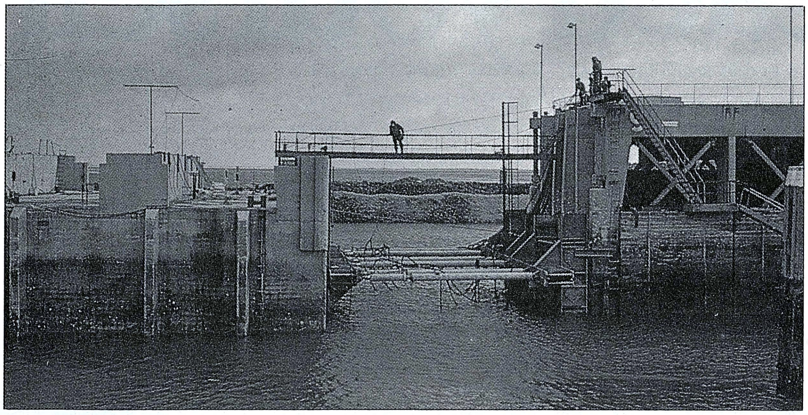


A one-third scale model of the Oosterschelde Barrier in the Netherlands, built to help determine whether the foundation of the actual wall could be constructed to withstand forces from the water.

look at the display and see how much movement of the walls was occurring and how much movement there had been in the last few days. "They could then judge whether they were approaching a problem or not."

A portion of this forecasting work was done in Geocomp's home office, using data Telexed from the site.

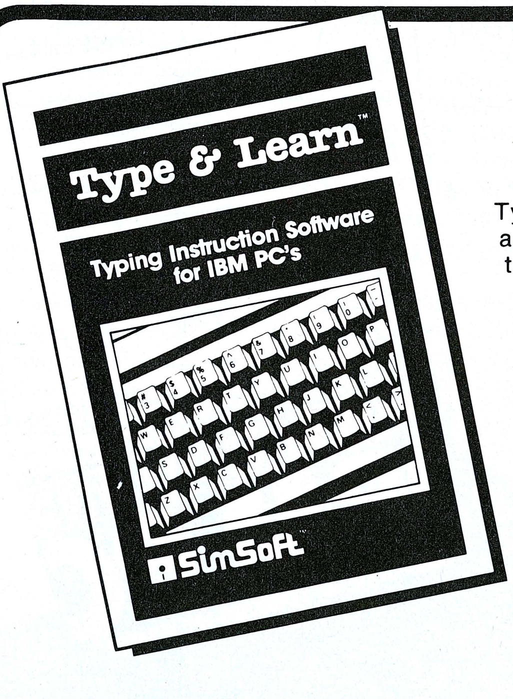
Historic Foundations. Geocomp is located in a three-hundred-year-old pink federal-period house with seventeen rooms. Like most of the other buildings in Concord, this one is seasoned with history.

The house was built in 1778 by a sea captain who ran an experimental vegetable farm. It was then bought by a judge who added on a studio with a skylight for his son, artist Daniel Chesterfrench, who carved the statue that sits in the Lincoln Memorial. Naval historian Samuel Elliot Morrison was another notable owner.

The studio was used later by another sculptor, Mary Odgen Abbott, who installed pulleys from the rafters to accommodate her ornate carved wood pieces. The studio skylight now looks down on a huge blond-wood table where the pc, a NEC printer, and three plotters square off. Abbott's pulleys aren't needed anymore; the new equipment is lighter, more compact, and as good looking as any set of artist's tools can be.

Most people who make the decision to go with IBM on the purchase of a personal computer do so because of Big Blue's reputation. Not so Geocomp. Marr and Urzua chose the pc in response to a "gut reaction."

"We prefer not being tied to any one manufacturer," says Marr. "We want to be free to move from one unit to another depending on client needs." They saw the pc, however, as the best all-around micro; it has been proving itself equal to many of the tasks once performed exclusively on larger machines. A wealth of programs—from generic stuff all engineers use to packages that Marr and Urzua themselves have



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written for commercial release—keep Geocomp's pc active.

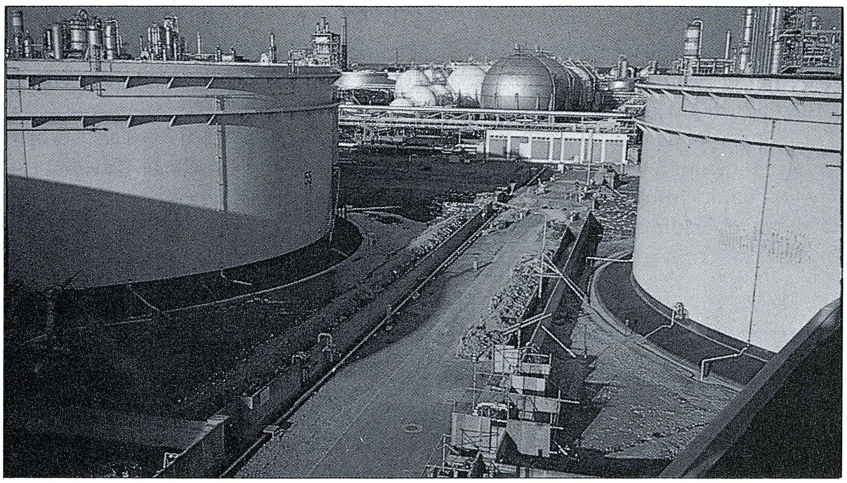
When program translation time came for Urzua last year, he found IBM's Fortran compiler for the pc less than adequate, so he has adopted Basic. To create their premier plotter program, *GeoGraf*, Urzua learned IBM Basic's built-in graphics language.

Languages "just come natural" to Urzua. "After you learn one, the others aren't much of a problem," he says. "Graphics is like a language; it's a way of expressing things. You tell the pc to put your numbers in such a way that the plotter will recognize and do something with them."

Adds Marr: "If you think moving from one language to another is hard, try moving a plotter program from one system to another. Each plotter has a different instruction set." For this reason the partners developed *GeoGraf*, which is designed to make engineering software more portable.

"Plotters are the whole heart of what we do," says Urzua. "The quality they allow us in the portrayal of events is a new thing. It's very impressive, and only a few companies have it."

Plots like the one depicting the settlement of the tanks (see photo on page 136), for example, are in many places still done by hand. "An engineer draws the circle, puts in the points, and then looks at the values," explains Urzua. "Then he visually interpolates between points and draws the contour lines."



These sixty-foot-tall oil tanks at a refinery in Kyogo, Japan, are sinking; over the last fifteen years, they've settled twelve feet into the ground. Marr is a member of a team of specialists called in to evaluate the situation on an ongoing basis.

Microcomputers and plotters, when programmed properly, can perform these operations with ease in a few seconds, although no one plotter can do every kind of technical plot. That's why Geocomp has three.

A Nicolet Zeta 1453 drum-type plotter allows long four-to-six-foot plots, "like when the upstream and downstream of a dam must be shown," explains Urzua. A Hewlett-Packard 7470A does single 8 1/2-by-11-inch plots and is "portable and reliable." A soon-to-be-released IBM XY/749 plotter is on loan from IBM Instru-

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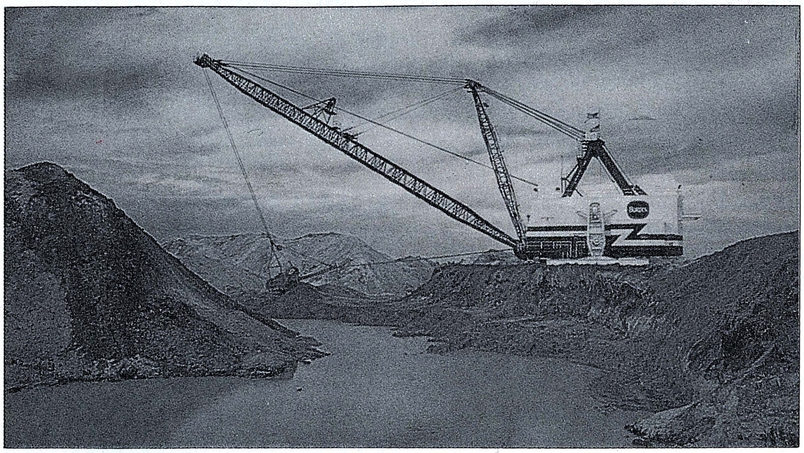
ments "to see how much of a problem we're going to have translating software to it."

The trio of plotters is hard-wired to the pc. Inside the pc, an 8087 does its share of the labor. A graphics card, 256K, two parallel ports, and one serial port round out the configuration. On a nearby table sit a Hayes Smartmodem, a Racal-Vadic modem, and Analog Device's MicroMac (used to obtain data from sensors for laboratory and field collection).



In mining operations, waste water is stored in small lakes held by stacked earth. Above: a digging operation for an earthen dam.

The graphic capabilities of the pc running the *GeoGraf* plotter program were best demonstrated on an earthen dam project in Colorado.

"We were called in to find out why this dam was sick," says Marr. The dam was leaking. "Now, all earthen dams leak, but the engineers couldn't figure where the water was coming from. They thought the dam might fail."

A program called *GeoFlow* was used to calculate how the water flowed through the earth. Again, instruments were sunk into the surrounding soil to take pressure readings.

What the plotted picture uncovered was the fact that a layer of subsoil under the dam was drinking up water from the upstream side of the dam and sending it flowing underground to the downstream side. The blue lines of the plot (see page 136) represent the flow of the water.

Several other similar problems with earthen dams have kept the pc and plotters busy. Increasingly, Marr and Urzua are using their pc's capabilities to analyze geotechnical problems in the areas of mining. One case involved litigation over a dam that had collapsed.

Litigation work is an after-the-fact kind of study as opposed to most consulting work, which deals in theory. In a typical situation, one party in a case may call in engineers as "disinterested experts."

"As part of a team, we're not in the position to decide why, for example, an excavation failed; that's for the judge and jury to decide. We just develop the facts regarding what *actually* occurred—as best we can," explains Marr.

A deposition phase, before the case actually goes before the bench, takes much of the drama out of the courtroom situation. Often the overwhelming evidence supplied by an engineering team causes a case to be settled out of court.

"In litigation work, you have to be more careful how you put things on paper. The lawyers go to a plot, and if they find one mistake—one glitch even out of the scope of discussion—if they're smart, they'll take it and turn the whole thing upside down," explains Urzua.

The courtroom work is good business, although it keeps the partners in jackets and ties more often than they'd like. Marr prefers to handle the more adventurous outdoor assignments, such as jobs "focused on large earth work projects, dams, mines, and excavations."

Geocomp's pc, however, sits patiently in Massachusetts, keeping an ear to the ground. ➤

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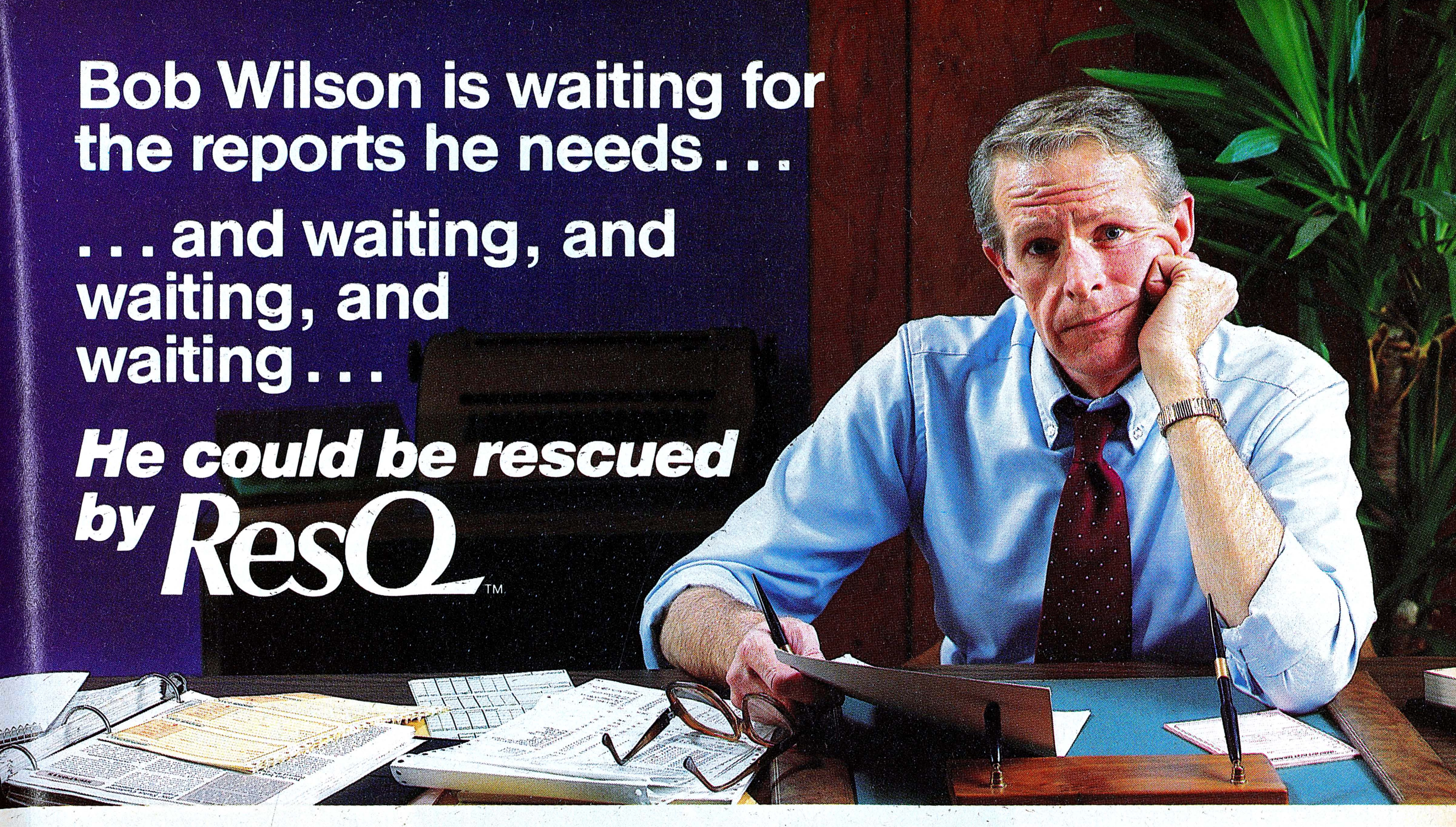

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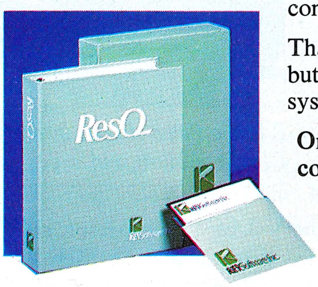

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CITY MAINTENANCE COMES OF AGE

Orange County, California, contains 1,600 miles of paved roads that need to be patched and stripped every year and four hundred miles of flood channels that need to be weeded and rodent controlled. The county employs two hundred maintenance workers to do these and hundreds of other jobs—like trimming trees, mowing park lawns, and removing tree stumps.

Thanks to Roy Jorgensen Associates, a Maryland-based public works management consulting firm, the upkeep of the county's civic pride is now handled from the keyboard of a pc, and, amazingly, the entire operation fits on two double-sided floppy disks.

A pc makes sure the lawns are mowed and the streets are cleaned.

Rancho Palos Verdes public works maintenance is supervised by Charlie Abbott and a pc.

Rancho Palos Verdes, a small, quiet, bedroom community in the neighboring county of Los Angeles, is serviced by a less complex version of Orange County's computerized maintenance system. With only 110 miles of road and a budget of one million dollars (compared to Orange County's thirty million) this city hires private firms to do its maintenance work. Farming out the city's upkeep is the job of a five-person staff headed by Charlie Abbott, deputy director of Jorgensen Associates.

Most cities, counties, and states don't define their public maintenance much on paper. "They say, 'We don't write it down, it's in our heads,' " explains Abbott. "They fix whatever looks like it has to be fixed." A lot of money and manhours are wasted this way.

Roy Jorgensen Associates's job is teaching management principles to maintenance people, bringing logic into the public works arena—a sprawling, sometimes neglected, branch of civil engineering. When the company is brought in, an entire management system is developed from scratch. A field manual is drawn up, defining all maintenance jobs, specifying things such as who does what and how much workers make per hour, what equipment is to be used, and how much of a job can be completed in a day. All the details from this field manual are entered into the pc.

The Jorgensen Work Management System menu is divided into three areas: scheduling and control, where activities are defined and recorded; planning and organization, where budget and workload are balanced; and file updates and prints, where department and resource parameters are maintained.

A job description card is printed for each crew day on a chore. The card shows labor and equipment needed, location, and planned time for the job. Filled out by the foreman, the job description card turns into an actual time card for the job.

Information entered from the cards is used for a monthly "exception report" that contrasts such factors as estimated versus actual completion time. "This is a quick way to look at maintenance performance," says Abbott—and was nearly impossible before computers were called in.

When Orange County officials hired the Jorgensen crew, they specifically asked that their maintenance program be designed to run on a micro, in particular, an IBM. All necessary information and calculating ability is at the county operations manager's fingertips in an interactive database that's accessed in a simple Q & A format. Only four hours a week are needed to operate the system, which is updated once a year.

"The maintenance department is controlling its own destiny now," says Abbott, who supervised the Orange County installation before he moved on to Rancho Palos Verdes. "Previously, any computer-related job was handled by the county's data processing department, and operations people were left in the cold; they couldn't get the information they needed."

Jorgensen consultants also work with a department's maintenance budget, organizing it in terms of cost per category. A built-in spreadsheet function in the program allows a person to "what if" any budget changes to see how they will affect the quality of current services.

Maintenance management is historically the black sheep of the civil engineering family. "While any good managers were doing this all along," says Abbott, "most engineers didn't worry much about future maintenance of a project. Resources weren't tight then. Now we have to be more efficient." ▲

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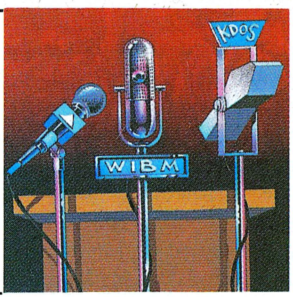

Unless otherwise indicated, software listed runs in DOS on machines with either display adapter and requires 64K and at least one disk drive.

Δ Three new arcade games and an adventure from **Sirius Software** (10364 Rockingham Drive, Sacramento, CA 95827; 916-366-1195): *Buzzard Bait* pits the player, on a rescue mission in a spaceship, against pairs of man-eating birds. $34.95. Δ *Gorgon II* has the player in a fighter plane attacking and destroying the man-eating monsters, with radar and hypercontrol on his side. $39.95. Δ *Space Eggs* has brightly colored eggs floating through space. When cracked open, dangerous aliens emerge. $34.95.

Δ Part of the *Chartman* business graphics series, *Chartman IV* provides specialized scatter charts, Gantt charts, intricate line charts, and a statistical curve-fitting feature. From **Graphic Software** (1972 Massachusetts Avenue, Cambridge, MA 02140; 617-491-2434). $300. Δ *Super Chartman II* is DOS 2.0-compatible and can print six charts per page. Switch from one chart format to another without reentering information. $425. Upgrade: $50. *Super Chartman II* and *Chartman IV* together: $500.

Δ Mainframe library functions are available with *PolyLibrarian*, a program that organizes related object code modules into a single library. The pc linker can then automatically select only the modules necessary to construct an executable program. From **Polytron** (Box 787, DS 2-208, Hillsboro, OR 97123; 503-640-2875). $99.

Δ To help parents on the road to computer literacy, **John Wiley and Sons** (605 Third Avenue, New York, NY 10158; 212-850-6000) has published *Microcomputers: A Parent's Guide*, by Robert D. Sherwood. The book evaluates software, publications, and other related educational tools. $8.95.

Δ A flow chart of any Basic program can be made with *The Documenter* from **P80Nut Software** (Box 490, Lilburn, GA 30247; 404-469-0056). The program also prints a branch map to allow you to determine the order of flow. $49.95.

Δ For on-line research of court decisions, WestLaw is a mainframe legal database for lawyers and accountants that can be accessed with *LawSearch* software from **Direct.Aid** (695-C South Broadway, Boulder, CO 80303; 303-494-8265). Requires 96K and 1200-baud modem. Green screen recommended for highlighting feature. $350.

Δ A version of CP/M-86 and Concurrent CP/M-86 for the XT has been announced by **Digital Research** (Box 579, Pacific Grove, CA 93950; 408-649-3896). Users can print documents while editing others; a graphics hardware extension is included. $60. Concurrent version: $350. Δ *Personal Basic*, a Basic for beginning programmers, has also been released. Language checks for errors as programs are written. Requires 96K. $150.

Δ Release 1A of *1-2-3* from **Lotus Development** (55 Wheeler Street, Cambridge, MA 02138; 617-492-7171) is compatible with the XT, DOS 2.0, the Hercules graphics card, Interactive PC Link software from McCormick and Dodge, and more brands of printers. $495. Five-disk upgrade: $20 or free, depending when original was purchased.

Δ Princeton Graphic Systems and Quadchrome display users can use the AD-I adapter to connect to the PC Pedestal from **Curtis Manufacturing** (20 Grove Street, Peterborough, NH 03458; 603-924-7803). Displays can be tilted and swiveled in any direction using the molded plastic pedestal that features air cooling slots and pc-matching design. Adapter: $9.95. Pedestal: $79.95.

Δ The *Sourcepak* is a communications software kit that enables you to log on and try out the information utility with ten days to decide if you want to subscribe. From **Source Telecomputing** (1615 Anderson Road, McLean, VA 22102; 703-734-7500). $100.

Δ Friends of Lisp/Logo & Kids (FOLLK) is a nonprofit organization promoting the use of micros as educational alternatives. Projects and services include newsletter, monthly meetings, and bulletin board. Contact **FOLLK** (254 Laguna Honda Boulevard, San Francisco, CA 94116; 415-753-6555).

Δ **California Computer Systems** (250 Caribbean Drive, Sunnyvale, CA 94086; 408-734-5811) has announced Super Vision, a hi-res video interface board that can display a full 132 columns on a standard monitor. $850. Piggyback graphics card: $250. Δ The Z80-B Processor Board allows CP/M access. Includes serial port. 64K: $875. 192K: $995.

Δ *Personal Computer Data Interface (PCDI)* is a software system that links a pc or XT to the IBM VM/370 mainframe operating system. From **Applied Microsystems** (Box 832, Roswell, GA 30077; 404-475-0832). The package includes telecommunications, data management, and interactive graphic analysis. You can pass data selected in *PCDI* immediately to other programs and manipulate it without having to leave the system. Requires 256K, modem, color/graphics adapter, and hard disk. $250. Corporate system installation available.

Δ The *Spring '83 Computer Supplies* catalog, featuring more than two hundred new products, is available from **Uarco** (121 North Ninth Street, DeKalb, IL 60115; 815-756-9581). Products range from computers and printers to multimedia storage cabinets. Catalog is free.

Δ *PC Number* is a Basic subroutine that solves the problem of numbers that appear on the screen or on a printed line in unwanted floating-point notation. From **Momentum Software** (533 Sutter Street, San Francisco, CA 94102; 415-982-7375). Disk includes example of program's use. $30.

Δ Addressing the need of *VisiCalc* users to format and generate comprehensive reports, *Reports By Example*, from **Solutions By Example** (Box 307, New Town Branch, Boston, MA 02258; 617-244-5880), can aid professionals in the banking, insurance, money management, and other related industries. $199.

Δ With its new *Stack* option, the least-cost feed blending program *Mixit-2* can calculate hundreds of different nutritional need formulas for a variety of farm animals. Rations are stored on disk and can be summarized in a one-page printout. From **Agricultural Software Consultants** (1706 Sante Fe, Kingsville, TX 78363; 512-595-1937). Requires 132-column printer. *Mixit-2*: $395. *Stack*: $295.

Δ *Wall Street Window*, a program that charts historical stock quotes from Dow Jones, can give up to one year of daily quotes or four years of monthly quotes. From **R&D Software Associates** (Box 2727, Reston, VA 22090; 703-476-6597). The software features charting capabilities, including high, low, close and volume, moving averages, relative strength, and more. $395. Demo: $75.

Δ **Best Programs** (Box 2370, Alexandria, VA 22301; 703-549-3663) announces the *Personal Computer/Fixed Asset System*, which keeps complete records of owned and leased property and equipment for the IRS, state and local governments, insurance companies, and business auditors. Fill out an on-screen form and the program does the calculations. Requires 96K for DOS 2.0 and eighty columns. $395.

Δ Designed by a certified financial planner, *Financial Fastrax*, from **Integrated Equity Planning** (98-211 Pali Momi Street, Aiea, HI 96701; 808-488-4766), provides flexible capabilities for advanced evaluations, planning, and projections. Includes twenty-seven formatted spreadsheet models (for *SuperCalc* or *1-2-3*), and a wide variety of interest, loan, and rate-of-return calculations. Requires 132-column printer. *SuperCalc*: $125. *1-2-3*: $150.

Δ A reference manual designed specifically for dealers, *The Personal Computer—An Industry Sourcebook* contains more than twenty-five hundred profiles of United States and overseas companies, completely cross-referenced. From **Chromatic Communications** (Box 3249, Walnut Creek, CA 94598; 415-945-1602). The publication contains eighteen classifications of manufacturers, periodicals, and more. $42.50.

Δ The revised edition of *Inside the IBM Personal Computer* is available from **Starware** (2000 K Street N.W., Washington, DC 20006; 202-331-8833). The thirty-six-page book supplements the IBM *Technical Reference* manual. Revised edition includes a design for a multifunction board. $14.

Δ An on-line database that covers the computer, telecommunications, and electronics fields has been announced by **Management Contents** (2265 Carlson Drive, Northbrook, IL 60062; 312-564-1006). The *Computer Database* includes abstracts of articles from more than five hundred periodicals and newsletters, as well as books and course materials. Materials can be ordered electronically. Price to be announced.

Δ *Blue* is a multiwindow word processor that lets you edit up to eight files in up to eight windows simultaneously. From **Symmetric Software** (1805 Clemson Street, San Bernardino, CA 92407; 714-887-8595). The program provides structure formatting capabilities for such things as chapters, sections, appendixes, and tables of contents, as well as the standard word processing features. Requires color/graphics adapter. $150.

Δ A structured database management system and a word processor are combined in *Super List Manager*, from **Pinnacle Software Systems** (Box 1220, Fort Collins, CO 80522; 303-224-5061). $249.

Δ *Stock Charting* is a tool for the technical analysis of a stock's price and volume movements. From **The Software Guild** (2937 Kalakaua Avenue, Honolulu, HI 96815; 808-922-1113). The disk stores all the data required to chart twenty securities. You type in high, low, close, and volume. Package also scales data for splits, store charts, and more. Requires double-sided disk drive and 96K. $69.95.

Δ **Sextant Systems** (Box 251, Holmdel, NJ 07733; 201-671-7670) has announced *Quill*, an advanced document preparation system for producing letters, memos, reports, articles, and manuals. Features include automatic table of contents, bibliographies, complete document sectioning, and indexing. Works in conjunction with a text editor to provide automatic paragraphing, page numbering, and right justification. $249. Δ *Microcrypt* is a file encryption system that provides security for your disk files as well as for information transmitted over modem. Examine the contents of any encrypted file without creating a permanently decrypted one. Works with any type of file. $95.

Δ **The Hayden Book Company** (50 Essex Street, Rochelle Park, NJ 07662; 201-843-0550) has released *Pascal Programs for Business*, by Tom Swan. The book contains a library of twenty-eight programs written in UCSD-compatible Apple Pascal. Beginning with simple statistical analysis, the author builds to more ambitious applications, such as a spreadsheet, a text-formatting program, and a bar-chart generator. Paperback, $15.95.

Δ Two programs that emulate advanced versions of small calculators have been announced by **CTEK** (748 East Colorado Boulevard, Pasadena, CA 91101; 213-795-7877). *PC Calculator* and *Programmable PC Calculator* have an accuracy of sixteen digits and various display options. The numbers in twenty-six working registers are displayed during calculation. Programmable version can create and access more than 250 calculation programs, each up to 102 steps in length. *PC Calculator*: $29.95. *Programmable PC Calculator*: $49.95. *Programmable PC with Financial Package*: $59.95.

Δ Fantasy Plaza is a shopping mall you can access over modem, which carries hardware and software products as well as electronic items, kitchenware, and health and beauty aids. After you've chosen goods on a simulated walk through various floors (IBM stuff is on the "fifth floor"), you return to the plaza cashier to choose method of payment. You may also chat with other buyers. Catalog available for toll-free ordering. A service of **Fantasy Plaza** (Box 6055, Burbank, CA 91510; 213-840-8211). To order by modem, dial (213) 244-1100.

Δ A version of the time-sharing *Prophit II* financial modeling system, called *Micro/Prophit*, is available from the **Victor Wortman Company** (305 San Vicente Boulevard, Santa Monica, CA 90402; 213-393-6281). A variety of ready-to-use model formats are available separately. Requires two disk drives or hard disk and 192K. $3,000. Models: $400 to $3,000.

Δ Two more *Data*Easy* business programs from **Data Consulting Group** (877 Bounty Drive, Foster City, CA 94404; 415-571-8100): *Project Scheduler* can display projects and show up to seven different tasks at a time. Projects can be as long as two years; up to ten weeks of information displayed at a time. $35. Δ *Bar Graph Generator* is a fill-in-the-blanks utility for creating statistical information. Does not require a color/graphics adapter. Three formats with up to fifteen time periods each. $35. Hard disk versions of both packages available.

Δ One hundred different popular tunes in such categories as pop, country and western, and television are contained in *Pick That Tune*, a game in which players bet on the number of notes it will take to name a song. From **Swearingen Software** (6312 West Little York, Houston, TX 77088; 713-937-6410). The game contains sixteen different playing variations for one to ten players. $29.95. Additional categories with one hundred tunes each: $9.95.

Δ Transfer files from DOS 1.0 or 1.1 to the p-System with the *DOSXfer* utility from **Look-Ahead Software** (1285 Easter Lane, Eagan, MN 55123; 612-454-3053). Text or data file types can be specified, allowing direct transfer to printer. DOS disks must be single sided. Requires two disk drives. $27.95.

Δ *AutoCom* is an asynchronous communications program that provides smart terminal and modem support, English configuration, unattended operation, and multiple text and data protocols. From **GKE Software** (236 North Santa Cruz Avenue, Los Gatos, CA 95030; 408-354-5010). The package allows the pc to emulate the DEC VT-100/VT-52 or ANSI terminal and use all of the host software up to 256K. $199. Δ *Crossdata* is a self-contained program that copies any file disk to disk between CP/M-86 and MS-DOS or PC-DOS. $99.

Δ *1-2-3* is now completely supported by the **Micro Decision Systems** (Box 1392, Pittsburgh, PA 15219; 412-276-2387) product line: *DocuCalc*, which shows a model's equations, labels, and values in a grid layout; *MergeCalc*, which operates on WKS files, either preserving formulas or using values, and *LoadCalc*, which reads simple text files and converts them to WKS files. Upgrade for each disk: $40.

Δ Part of their new floppy-disk size reference series, intended to eliminate lengthy searches through manuals, the *IBM PC Disk-*

Guide and the *VisiCalc DiskGuide* have been published by **Osborne/McGraw-Hill** (2600 Tenth Street, Berkeley, CA 94710; 415-548-2805). PC edition is a compact guide to Basic and operating system statements, commands, and keywords. The *VisiCalc* edition summarizes entries, commands, files, and special keys. $6.95 and $8.95.

Δ **Software Options** (19 Rector Street, New York, NY 10006; 212-785-8285) announces *Data-Writer*, an information management system for managing text and numeric data. Includes mail-merge function and integrated text editor. $225. Δ *Portfolio* is a portfolio management system for managing portfolios of futures and options; calculates proper hedge equivalents for each option position. $995.

Δ The *Jewelry Appraisal System* simplifies the writing of appraisals by composing sentences from an appraiser's input. From **Soft-Ray Systems** (Box 70711, Sunnyvale, CA 94086; 408-733-1938). The program performs such functions as calculating by formula the approximate weight of a set stone. Requires eighty columns and a printer. $500.

Δ Aimed at the financial planning, insurance, and banking markets, the *Professional Financial Planner and Asset Manager System* can be used as a revenue generator. It's a complete turnkey client management system for financial planners, from **Professional Software Associates** (5353 Wayzata Boulevard, Minneapolis, MN 55416; 612-541-0742). $2,000.

Δ More than two hundred professionally written letters are contained in *LetterBank*, a correspondence application package from the **Wyndham Group** (125 Mirona Road, Portsmouth, NH 03801; 800-972-5600). Letters include sales promotions, employee firings, past-due accounts, memos, and more. Each one can be modified to suit and printed singly or in batch mode. Requires two disk drives. $99.

Δ An expansion chassis from **I-Bus Systems** (8863 Balboa Avenue, San Diego, CA 92123; 619-569-0646) contains a forty-watt power supply and backplane with six expansion slots. No additional software required; expansion is made by a direct extension of the I/O bus. Operation is quiet; the unit contains no fan. $695. With four-foot cable. $755.

Δ *Master Utilities #1*, from **Microtek** (4750 Viewridge Avenue, San Diego, CA 92123; 619-569-0900), contains three programs: Masterspooler I, which allows the user to assign any portion of the available memory as a spooler driving the serial printer port; Masterspooler II, which is a parallel port duplication of I; and Masterdisc, a disk emulation program. $49.95. Δ *Master Utilities Volume II* contains ten utilities, including a DOS directory sorter, graphic screen dump routines, large definable screen print fonts, printing formats for disk labels, and more. Full screen editor and formatter turn the package into a miniword processor. $99.95.

Δ *Peachfix*, from **Micro-Comp Business Enterprises** (5021 Kurt Lane, Conyers, GA 30208; 404-374-6225), allows the placing of the IBM/Peachtree version 1.0 accounting programs onto one 320K disk, eliminating the chore of changing disks between menus. $24.95. Δ *The Stock Price Catalog* package interfaces an electronic stock price catalog with the IBM/Peachtree accounts receivable package for automatic pricing and the control of inventory. $494.95. Δ *Law-Word* is a legal spelling dictionary, compatible with *SpellStar* and other spelling checkers, based on a famous legal dictionary. $49.95.

Δ *Enchanter* is the first in a new trilogy of fantasy games from Marc Blank and Dave Lebling, authors of *Zork*. The new game is a journey into an environment where you'll need skill and logic to overcome Krill, the evil warlock. The emphasis in *Zork* is on treasure

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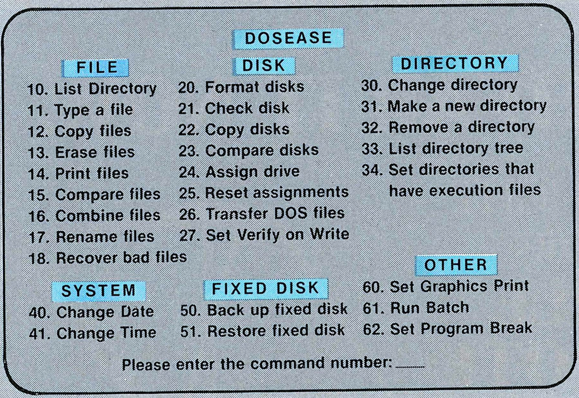
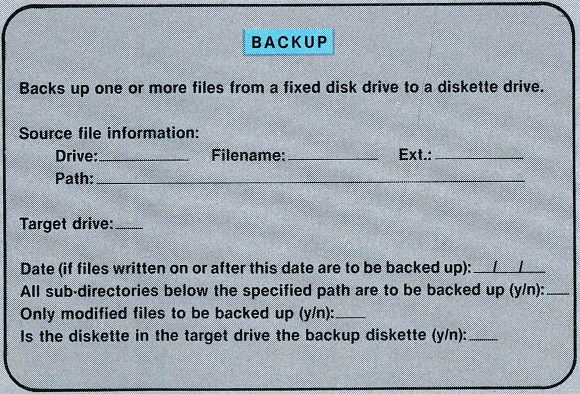
DOSEASE displays a menu that describes the function you selected and gives you the available options. You select the desired options and enter the required data which DOSEASE verifies.

Press the ENTER key when you have made your selections. DOSEASE then commands PC-DOS to perform the requested function. When this function has been completed, DOSEASE returns a menu so you can continue your work.



```
                        DOSEASE
   FILE                  DISK                    DIRECTORY
10. List Directory   20. Format disks        30. Change directory
11. Type a file      21. Check disk          31. Make a new directory
12. Copy files       22. Copy disks          32. Remove a directory
13. Erase files      23. Compare disks       33. List directory tree
14. Print files      24. Assign drive        34. Set directories that
15. Compare files    25. Reset assignments       have execution files
16. Combine files    26. Transfer DOS files
17. Rename files     27. Set Verify on Write
18. Recover bad files                              OTHER
   SYSTEM              FIXED DISK            60. Set Graphics Print
40. Change Date      50. Back up fixed disk  61. Run Batch
41. Change Time      51. Restore fixed disk  62. Set Program Break
         Please enter the command number: ____
```



```
                         BACKUP

Backs up one or more files from a fixed disk drive to a diskette drive.

Source file information:
    Drive:_______    Filename:_______    Ext.:_______
    Path:______________________________________

Target drive:___

Date (if files written on or after this date are to be backed up):__/__/__
All sub-directories below the specified path are to be backed up (y/n):__
Only modified files to be backed up (y/n):__
Is the diskette in the target drive the backup diskette (y/n):__
```

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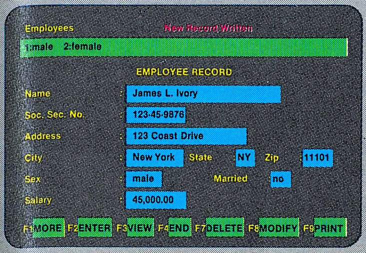


```
Employees                    New Record Written
1:male  2:female
                EMPLOYEE RECORD
Name          : James L. Ivory
Soc. Sec. No. : 123-45-9876
Address       : 123 Coast Drive
City          : New York   State :NY   Zip :11101
Sex           : male       Married :no
Salary        : 45,000.00
F1MORE F2ENTER F3VIEW F4END F7DELETE F8MODIFY F9PRINT
```

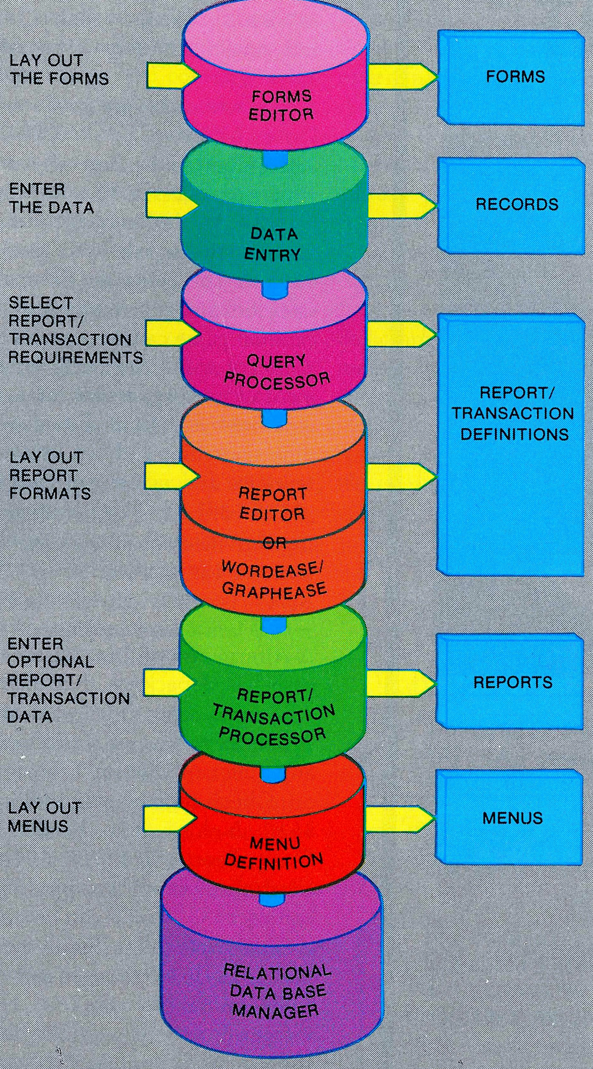
- Fully menu driven to remove the guesswork.
- Full use of function keys with the assignments always displayed. All cursor movement and editing functions on the keyboard are supported.
- Provides full color support and screen style customization.

System Features:

- A list of users can be kept, with passwords and security levels.
- The print style is customizable.
- Data can be interchanged with mainframe computers, other data bases or spreadsheet programs.
- Data base back-up and restore functions are integrated to reduce errors.

System Requirements:

- Available on IBM-PC, DEC Rainbow and other 16 bit computers. Requires 128K of memory and 2 disk drives.
- Supports floppy or hard disk drives.
- Supports all popular printers.


LAY OUT THE FORMS
FORMS EDITOR
FORMS
ENTER THE DATA
DATA ENTRY
RECORDS
SELECT REPORT/ TRANSACTION REQUIREMENTS
QUERY PROCESSOR
REPORT/ TRANSACTION DEFINITIONS
LAY OUT REPORT FORMATS
REPORT EDITOR OR WORDEASE/ GRAPHEASE
ENTER OPTIONAL REPORT/ TRANSACTION DATA
REPORT/ TRANSACTION PROCESSOR
REPORTS
LAY OUT MENUS
MENU DEFINITION
MENUS
RELATIONAL DATA BASE MANAGER

It Provides A Complete Range of Features:

- Lay out your forms on the screen. Define data-entry fields anywhere by answering simple questions. Revise the forms any time without losing data.
- Easy, fast and accurate way to fill-in the forms and enter, view or revise records.
- The reports or transactions requirements are defined in the English-like query language by answering simple questions. Select records any number of ways, combine up to 5 forms per report, perform calculations, get totals, sub-totals, or statistical summary. For complete transaction processing, delete, modify or enter records.
- Reports are automatically formatted in several ways, or specify your own format using the Report Editor.
- To format a report complete with text, data, and graphs; use the optional WORDEASE™ word-processor or the GRAPHEASE™ graphics facility.
- Display or print the report output, or take it to your spreadsheet, word processing, or graphics programs.
- Organize the access to your forms and reports by setting up your own menus.
- The underlying Relational Data Base Manager provides efficient storage and retrieval of records. It uses B-tree indices for efficient accessing of records, and cache memory to retain the most recently used disk sectors to reduce disk access by 50 percent.

These are Some of the DATAEASE Applications:

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Personnel Management
Job Accounting
Mailing List
Accounting
Order Processing
Market Analysis
Financial Portfolio
Medical Office Systems
Real Estate
Agriculture
Distribution Management
Social Sciences
Bibliography
Library Management
School Records

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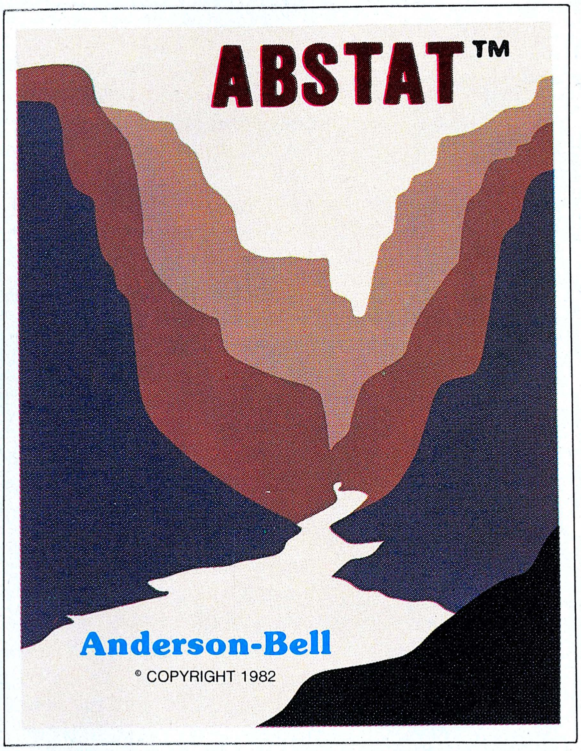

If you are using dBase II for accounting, inventory control, marketing or scientific applications, ABSTAT provides you with the ability to perform statistical data analysis with ease!

If you are not using dBase II, that's OK, because ABSTAT is a stand-alone package that can share data with other software through ASCII files.

ABSTAT facilities include full data manipulation and editing, on line help and comprehensive statistical procedures, including analysis of variance, cross tabulation, multiple regression, Z scores and much more.

ABSOLUTELY the most flexible, simple yet comprehensive statistics and data analysis package available for the IBM-PC.

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and magic; the emphasis in *Enchanter* is "clearly on magic," according to **Infocom** (55 Wheeler Street, Cambridge, MA 02138; 617-492-1031). $49.95.

Δ Currently in use on mini and mainframe computers, the *Muse 4.0* office-grade word processing package is now available for the pc and XT. From **Marc Software International** (260 Sheridan Avenue, Palo Alto, CA 94306; 415-326-1971). The software can execute complicated layouts and format styles with just a few keystrokes. Includes spelling checker, mail-list processor, column move, decimal tabs, copying and moving of documents, and more advanced features, such as cursor-controlled document handling. Includes full support for the Diablo 630 ECS printer. $595.

Δ A floppy disk directory of thirty-eight disks full of useful and entertaining public domain programs is available from **PC Software Interest Group** (1556 Halford Avenue, Santa Clara, CA 95051; 408-247-6303). Games, spoolers, database managers, graphics, utilities, and music are only a few of the types of programs you can order. $3.

Δ Five new software products from **System Vision** (199 California Drive, Millbrae, CA 94030; 415-697-3861): *Gina+* is an updated and enhanced version of the SVC sales assistant program *Gina*, which produces a system proposal tied to the retailer's active inventory. Dealer customizable. $499. Δ *Eureka!* is a sales prospecting system for sales professionals who don't like to keep records. $150. Δ *The Computer Companion* is designed to be a retailer post-sales tool and aid to computer literacy. Tutorials, charts, and an educational game can be customized for customer support use. $19.95. Δ *Emcee* is an authoring language specifically for rapid development of prototypes and interactive demonstrations. $99. Δ *The Resume Bank* is a resume management system oriented to on-line resume searching and reporting. Additional information, such as interviews and notes, can also be stored. $250.

Δ For banks and corporations that engage in foreign exchange trading activities, the *Foreign Exchange Trading System*, from **Nissim Associates** (2714 Pine Street, San Francisco, CA 94115; 415-563-6170), is a new accounting module that complements the company's *Multi-Currency General Ledger*. $5,800.

Δ A farm accounting control system, called *FACS*, is a single-entry, cash-based package that maintains up to three hundred accounts with nine reporting levels and tracks both paid and unpaid expenses as well as units and weight. Trial closings can be generated at any time, and the trial balance report verifies sales, expenses, and so on. Check register and *VisiCalc* conversion interface also included. $525. Δ Also from **Vertical Software** (502 East War Memorial Drive, Peoria, IL 61614; 309-688-2377): *Commtrac*, a commodities charting program that produces charts and graphs for commodities contracts. Contracts can be updated automatically by modem. $300.

Δ **SuperSoft** (1713 South Neil Street, Champaign, IL 61820; 217-359-2112) has released a new version of their C compiler. Syntactically compatible with Unix version 7C, the compiler supports long integer functions and double floating-point functions (including trigonometric functions). Requires CP/M-86. $500.

Δ The *CertiFlex Business Accounting Package*, from **Computer Program Associates** (2526 Manana Drive, Dallas, TX 75220; 214-350-2361), includes general ledger, accounts payable with check writing, accounts receivable with billing, inventory control and management, and payroll with check-writing. Designed by certified public accountants. Each module is compatible with a variety of hard disks. $549 per module.

Δ The *ResQ* database management system offers up to sixty fields per record and eighty characters per field. The package has searched two hundred records by key in 2.5 seconds, according to **Key Software** (2350 East Devon Avenue, Des Plaines, IL 60018; 312-298-3610). Built-in calculator function can produce reports or projections. $395.

Δ **Monument Computer Services** (Village Data Center, Box 603, Joshua Tree, CA 92252; 619-365-6668) announces *Power Pac I*, a three-utility package that includes the Formatted Lister, which defines headings, numbers, and margins; the DiskMod Program, which allows users to read and inspect sectors on a disk; and the Basic Variable Cross Reference Program. Requires printer. $79.95.

Δ A monthly loose-leaf publication with descriptions of key hardware, software, books, and magazines for the pc has been released by **Query** (Box 21, Bogota, NJ 07603; 201-836-7389). *InfoSource for the IBM PC* includes product comparison charts, vendors' addresses, explanations of requirements, and so on. Pages are mailed to subscribers each month. Annual subscription: $69. Current edition: $30.95.

Δ A Swedish-based conglomerate, **Axel Johnson** (666 Howard Street, San Francisco, CA 94105; 415-777-3800) has begun marketing *Autocode I*, a program generator for *dBase II*. The program automatically writes a database management program in seconds, based on answers to a few simple questions. It also contains both alphanumeric and numeric range-error checking and error trapping, calculated fields, and selective field report generation. $195.

Δ A banking software package has been released by **Sendero** (1118 East Missouri, Phoenix, AZ 85014; 602-279-0401). Called *Micro FRS* (financial results simulator), the program handles complex asset/liability planning and financial statement preparation. Can quickly calculate and format the effects of changing target balances, key rates, and other banking variables for ratio and gap analysis and balance sheets. From $3,500.

Δ With listings of over 950 products from 330 companies, the *ICP Software Directory: Business Applications for Microcomputers* offers essential software information. From **Robert J. Brady** (Route 197, Bowie, MD 20715; 301-262-6300). $19.95.

Δ Reformatter conversion software allows a pc configured with an eight-inch add-on drive to read and write disks in the IBM 3740 mainframe format. From **MicroTech Exports** (467 Hamilton Avenue, Palo Alto, CA 94301; 415-324-9114). The package allows data to be transferred to larger systems by a simple exchange of disks. Displays and alters directories, displays and dumps records, translates code from ASCII to EBCDIC and back, and more. Requires eight-inch floppy disk drive. $350.

Δ A set of Pascal-callable library routines featuring color graphics, screen control, and music generation has been announced by **Software Labs** (1052 Lily Avenue, Sunnyvale, CA 94086; 408-241-9539). The *Pascal Utilities Package* provides the programmer with many of the extended features found in Advanced Basic, including routines to draw dots, lines, and circles; store and retrieve images; interface with light pens and joysticks; and more. Demo included. $119.

Δ The *Omnus Security Controller* is a microprocessor-based hardware security system for both residential and commercial situations. From **Zena Micro Engineering** (4200 Twenty-third Avenue West, Seattle, WA 98106; 206-282-0100). The system directly connects to the pc to provide enhanced monitoring and protection without relying on or interfering with the regular operation of the computer. Operates fully functional as a standalone unit with its own battery backup. Voice output, light control, and other options available. Price to be announced.

Δ An adapter-based graphics system that increases animation speed from seven to sixty screens per second has been announced by **Micrographics Technology** (1820 McCarthy Boulevard, Milpitas, CA 95035; 408-996-8423). The *Master Graphics* system features hardware interrupt logic and dual display buffers for smoothing animation, MasterPallette for increasing available colors to 4,096, and software for creating a custom character set. Utility subroutines in Basic, Pascal, and Fortran included. $579.

Δ A powerful package of color graphics routines, dubbed *Halo*, has been released by **Lifeboat Associates** (1651 Third Avenue, New York, NY 10028; 212-860-0300). The program provides assembly language graphics primitives (line, arc, bar, pie, and so on) that can be included in other programs. Interfaces available for Basic (interpreted or compiled), Pascal, Lattice C, Fortran, and assembler. Requires 96K. $150.

Δ *SPOC the Chessmaster* is a program that lets you play the game against the computer. Piece movement is accomplished by means of the directional arrows on the keyboard. Captured pieces are displayed on the sides of the chess board. Two clocks are also displayed. From **Cypress Software** (1450 Koll Circle, San Jose, CA 95112; 408-995-5186). Color or mono. $39.95.

Δ Software that allows CP/M-86 to run on MS-DOS or PC-DOS systems has been created by **American CompuSoft** (23113A Plaza Pointe Drive, Laguna Hills, CA 92653; 714-472-8186). Call *MatchPoint/86*, the package features a routine called FileComingle that allows the user to call and use information stored in CP/M-86 while operating in DOS, or vice versa. Works on floppies as well as hard disks. $99.

Δ An office management module has been released for the *Medical Manager* by **Systems Plus** (1120 San Antonio Road, Palo Alto, CA 94303; 415-969-7047). The module extends beyond the package's financial and billing aspects to include reports, generated at any time, on all aspects of a patient's medical history and on the physician's schedule. Requires CP/M-86. $400.

Δ A two-package, system-independent graphic support system for Basic provides professional graphics capabilities normally found on mainframe, according to **Graphic Software** (1972 Massachusetts Avenue, Cambridge, MA 02140; 617-491-2434), makers of the *Softplot/BGL* system. *BGL* is a graphics language that provides functions comparable to CORE and GKS base levels. *Emuplot* is a plotter emulator for dot-matrix printers that does hi-res hard-copy graphics by reading plotter commands from a disk file. $200. ▲

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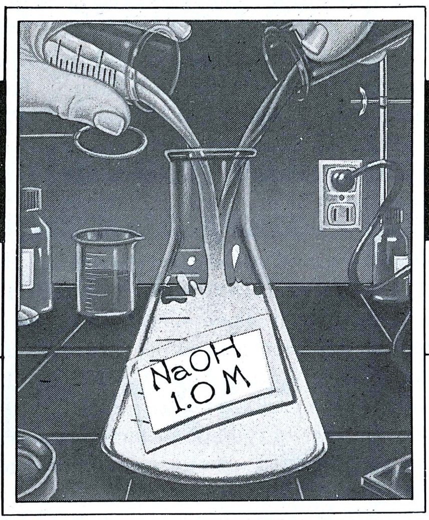

by Joe Juhasz

Full-Screen Data Entry

A friend has just written a program that keeps track of customer information. It's a nice, easy-to-use program that asks questions about each customer and stores the information in a disk file. Most likely the program uses Basic's *input* statement and an approach somewhat like this:

The program asks:	**Enter customer number?"**
You type:	**12345 [enter]**
The program asks:	**"Enter customer name?"**
You respond:	**John Smith [enter]**
The program asks:	**"Enter address?"**
And you say:	**111 First Street [enter]**

And so on until all the information has been entered.

At this time, you're usually asked if you want to make any changes; if you do, you're asked which information you'd like to change.

This approach to data entry can be called *question and answer*. It's an easy enough way to get the data on disk, but it becomes tedious. The tedium comes, in part, from the fact that this approach is clumsy for editing information. For example, if you realize you've misspelled a customer's name, you still need to answer all the questions before you can correct the spelling error. And when you do correct it, you usually need to retype the entire name.

There's gotta be a better way, you say. And indeed there is. We'll call it *full-screen data entry*.

The full-screen method allows you to enter or change any piece of information (any *field*) at any time. The tab, enter, and cursor keys are used to move you around the screen. Normally, a function key is enabled to write the information to disk. Other function keys can be set up to delete or clear information or to end the session.

Our sample program this month includes all the code needed to handle cursor movement about the screen, acceptance of data, and decoding of the function keys. The code is table driven, which means that tables (as Basic arrays) are set up to tell the program what information is needed (name, address, age, or whatever), the length and type of information required, and its position on the screen. We call these tables *data description tables*.

The main advantage of table-driven programs is the ease with which they can be modified. To change the location on-screen for a particular field, we need only change an entry in the table. If we decide we no longer want a particular field, we can remove its table entry. To ask for additional information, we need only add more table entries.

Here's an example of a data description table:

Field name	**Type**	**Length**	**Row**	**Column**
Customer name	N(3)	4	2	40
Customer name	a(1)	30	3	5
Address	a(1)	30	4	5
Occupation code	A(2)	4	6	5
Amount due	N(3)	7	6	25

Our program handles three data types:

A	**Alphanumeric, automatically capitalized**
a	**Alphanumeric, upper and lower case**
N	**Numeric, including plus and minus signs and decimal points**

The routines CkKey and CkField, described in the April and May installments of this column, are used to input the data and decode the tab and function keys.

These tables can be stored as files on disk so that changes can be made without modification to the program itself. Thus if you have compiled your program you can make changes to the amount, type, and location of data without having to recompile.

The tab and enter keys take us from field to field. The shift-tab key moves us to the previous field in the table. Notice that our table is in order by row and column. This allows the tabbing from field to field to be similar to the way we read—left to right, top to bottom. Our tabbing will wrap around, so if we hit enter when we're at the last field on the screen, we'll move to the first field on the screen.

Function-10 signifies that we've finished entering data. The record completed would most likely be written to disk at this time.

Function-1 signifies that we wish to end our session.

One final note: In line 3080 the variable Display should be set for the correct display: 1 for monochrome, 2 for color.

```
1000 ' *** ********************************************************* ***
1010 ' ***    F U L L   S C R E E N   D A T A   E N T R Y        ***
1020 ' *** ********************************************************* ***
1030 '
1040   GOSUB 3040                                    -Initialize variables
1050 '
1060   '** ------------------------------------------------------------**
1070   '**-- The following code allows us to go from field to field --**
1080   '**-- entering or changing data.                              --**
1090   '**--                                                         --**
1091   '**-- The variable F will be the field number.                --**
1092   '**--                                                         --**
```

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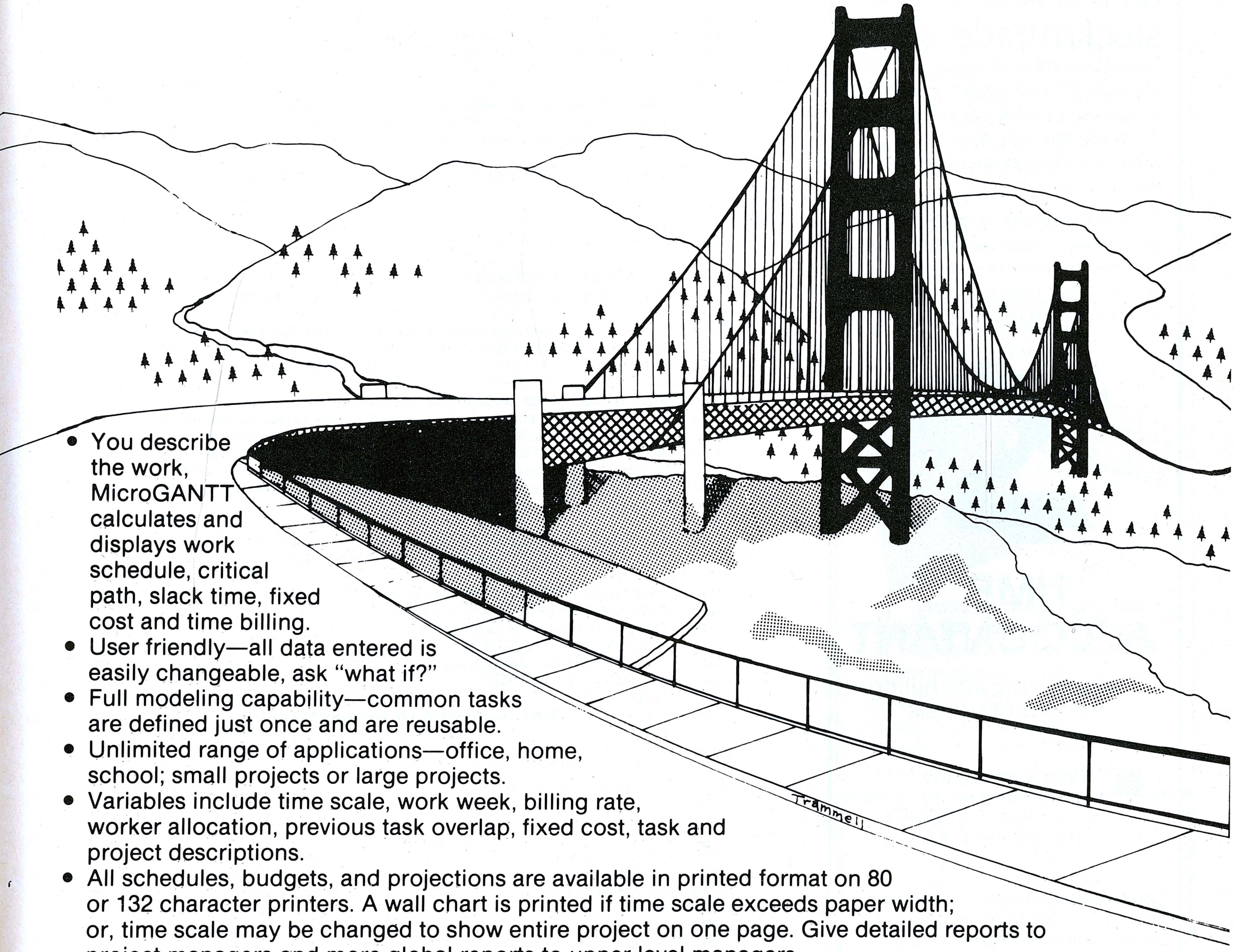

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```
1100    '**-- 3 data types are allowed:                                  --**
1110    '**--       'a' (1) - alphanumeric (upper and lower case)        --**
1120    '**--       'A' (2) - alphanumeric (automatically capitalized) --**
1130    '**--       'N' (3) - numeric (allows digits and " +-."          --**
1140    '**--                                                            --**
1150    '**-- 2 Function Keys are accepted:                              --**
1160    '**--       F10 - signifies that we have finished entering       --**
1170    '**--             data for this customer.                        --**
1180    '**--       F1  - signifies that we wish to end session.         --**
1190    '**--                                                            --**
1200    '**-- The TAB and ENTER keys take us to the next field.          --**
1210    '**-- The shift TAB key takes us to the previous field.          --**
1220    '**--                                                            --**
1230    '**-- Data will be stored in the string array FLD.DATA$.         --**
1240    '** ------------------------------------------------------------**
1250 '
1260    GOSUB 2020    '-display field names and underlined area to enter data
1270 '
1280    '**----------------------------------------**
1290    '**-- Now go from field to field accepting --**
1300    '**-- data until F1 or F10 is pressed.     --**
1310    '**----------------------------------------**
1320 '
1330    '-set up CKfield calling variables common to all field types-
1340    FKEYS=3: FKEY.A(1)=1:   FKEY.A(2)=10        '-allow F1 and F10
1350             FKEY.A(3)=SHIFT.TAB                '-allow Shift-Tab
1360 '
1370    COLOR UNDERLINE,BLACK                       'set color for underline
1380 '
1390 '*---------------
1400    F=1                                         '-start with first field
1410 '*---------------
1420 '
1430    IF F<1 THEN F=NUM.FIELDS                    '-adjust field number to
1440    IF F>NUM.FIELDS THEN F=1                    '-wrap at start or end
1450 '
1460    '-set up to get input using correct routine depending on field type.
1470    ON FLD.TYPE(F) GOSUB 1750, 1810, 1870
1480    GOSUB 1920                              '-now get user's input
1490 '
1500 '  '-test last key pressed (ENTER, TAB, SHIFT-TAB, F1, or F10)
1510    IF FKEY=1 GOTO 1580                     '-if F1 pressed then we are done
1520    FLD.DATA$(F)=CKFIELD$                   '-save entered or modified data
1530    IF FKEY=10 GOTO 1610                    '-if F10 pressed then handle
1540    IF TCKI = SHIFT.TAB THEN F=F-1: GOTO 1430   '-get previous field
1550    F=F+1                                   '-that only leaves ENTER or TAB
1560 GOTO 1430
1570 '
1580 '*** F1 pressed *** Replace with your own code ***
1590    LOCATE 25,1: PRINT "Function Key #1 Pressed - END";
1600 GOTO 1600
1610 '*** F10 pressed *** Replace with your own code ***
1620    COLOR BLACK,WHITE
1630    LOCATE 15,1
1640    FOR F=1 TO NUM.FIELDS
1650          PRINT "Field ";F;"= ";
1660          PRINT FLD.DATA$(F)
1670    NEXT
1680    LOCATE 25,1: PRINT "Function Key #10 Pressed - ADD";
1690 GOTO 1690
1700 '
1710    ' *** ******************** ***
1720    ' *** Routines by field type ***
1730    ' *** ******************** ***
1740 '
1750 '***--get "a" type data (field.type=1)--**
1760    MINKEY=ASC(" "): MAXKEY=126             '-set min and max range
1770    CAPSON=FALSE                            '-capitals not necessary
1780    CALLER=0                                '-caller not used
1790 RETURN
1800 '
1810 '***--get "A" type data (field.type=2)--**
1820    MINKEY=ASC(" "): MAXKEY=126             '-set min and max range
1830    CAPSON=TRUE                             '-force capitals
1840    CALLER=0                                '-caller not used
1850 RETURN
1860 '
1870 '***--get "N" type data (field.type=3)--**
1880    MINKEY=ASC("0"): MAXKEY=ASC("9")        '-set min and max range
1890    CALLER=3                                '-allow " +-."
1900 RETURN
1910 '
1920    ' *** ********************** ***
1930    ' *** Call CKfield to get data ***
1940    ' *** ********************** ***
1950 '
1960    F.ROW=FLD.ROW(F)                        '-set row
1970    F.COL=FLD.COL(F)+LEN(FLD.NAME$(F))+1    '-set column of field
```

```
1980    F.FL=FLD.LENGTH(F)                        '-set max length of field
1990    GOSUB 5000                                '-call CKFIELD
2000 RETURN
2010 '
2020       '*** ***************************************** ***
2030       '*** Display screen (prompts and underlined area) ***
2040       '*** ***************************************** ***
2050 '
2060    COLOR WHITE,BLACK
2070    CLS                                   '-clear the screen
2080    FOR F=1 TO NUM.FIELDS
2090       COLOR WHITE,BLACK
2100       LOCATE FLD.ROW(F),FLD.COL(F): PRINT FLD.NAME$(F);" ";
2110       COLOR UNDERLINE,BLACK
2120       PRINT SPACE$(FLD.LENGTH(F))        '-show line of fld.length spaces
2130    NEXT
2140 RETURN
2150 '
2160       '*** *********************************** ***
2170       '*** READ DATA DESCRIPTION TABLES ***
2180       '*** *********************************** ***
2190 '
2200    FOR F=1 TO 5
2210       READ FLD.NAME$(F), FLD.TYPE(F), FLD.LENGTH(F), FLD.ROW(F), FLD.COL(F)
2220    NEXT
2230 RETURN
2240 '
3000    ' *** ******************************** ***
3010    ' ***    I N I T I A L I Z A T I O N    ***
3020    ' *** ******************************** ***
3030 '
3040    KEY OFF: FOR I=1 TO 10: KEY I," ": NEXT '-Turn off function keys
3050    TRUE=-1: FALSE=0                        '-Set up TRUE, FALSE switches
3060    DISPLAY=1                               '-1:MONO or 2:GRAPHICS adptr
3070    BLACK=0: WHITE=7: UNDERLINE=1           '-Set colors for mono display
3080    ENTER$=CHR$(13): BKSPC$=CHR$(8): ESC$=CHR$(27)
3090    DIM FKEY.A(15), LKEYS$(10)              '-dimension arrays
3100    F.FIELD$=SPACE$(79)                     '-set f.field$ max of 79 chars
3110    RTAB$=CHR$(9): SHIFT.TAB=15: RARW=77: LARW=75
3120    I$=CHR$(0): SPECIAL$=I$+"K"+I$+"M"+I$+"S"+I$+"R"+I$+"O"+I$+"s"+I$+"u"
3130                      ' 00+75 /00+77 /00+83 /00+82 /00+79 /00+115/00+117
3140 '***Set up allowable sets of keys
3150    LKEYS$(0)=""              '-CALLER=0 no keys outside of range allowed
3160    LKEYS$(1)=" "             '-CALLER=1 allows space
3170    LKEYS$(2)=""              '-CALLER=2 not used
3180    LKEYS$(3)=" +-."          '-CALLER=3 allows decimal point, + - signs
3190 '
3200       '*** *************************** ***
3210       '*** Read Data Description Tables ***
3220       '*** *************************** ***
3230 '
3240    FOR F=1 TO 100                         '-Allows for maximum of 100 fields
3250       READ FLD.NAME$(F), FLD.TYPE(F), FLD.LENGTH(F), FLD.ROW(F), FLD.COL(F)
3260       IF FLD.TYPE(F)=0 GOTO 3280          '-Test for end of table data
3270    NEXT
3280    NUM.FIELDS=F-1                         '-Store number of fields
3290 '
3300      DATA  "Customer Number",  3,  4,  2, 40
3310      DATA  "Customer Name",    1, 30,  3,  5
3320      DATA  "Address",          1, 30,  4,  5
3330      DATA  "Account Code",     2,  4,  6,  5
3340      DATA  " ",                0,  0,  0,  0
3350 RETURN
4000 '
4010            ' *** ******** ***
4020            ' *** CK KEY ***
4030            ' *** ******** ***
4040 '*** ckkey ***
4050    IF INKEY$><" " GOTO 4050                         '-clear keystroke buffer
4060    FKEY=0: TCKI=0                                   '-reset variables
4070    CK$=INKEY$: IF CK$="" GOTO 4070                  '-wait, place keystroke in CK$
4080 '** If CAPSON then convert to uppercase
4090   IF CAPSON AND CK$>="a" AND CK$<="z" THEN CK$=CHR$(ASC(CK$) AND &HDF)
4100 '** For special keys (such as function keys) INKEY$ returns 00 + xx
4110 '** To process these special keys goto line 5160
4120   CK=ASC(CK$): IF CK=0 GOTO 4210                    '-check for special keys
4130 '** Check key and see if it was within allowable range
4140   IF CK>=MINKEY AND CK<=MAXKEY GOTO 4320'-good keys
4150 '** Following statement is used in field processing (see next issue)
4160   IF CKFIELD.SW AND (CK$=ENTER$ OR CK$=BKSPC$) GOTO 4320
4170 '** Check key and see if it is part of allowable set of keys
4180   IF INSTR(LKEYS$(CALLER),CK$)=0 GOTO 4310 ELSE GOTO 4320
4190                                        '=0 error       NOT=0 okay
4200 '** Process special keys (00 + xx)
4210   TCKI=ASC(RIGHT$(CK$,1))                           '-get second byte of special key
4220 '** Special test to determine if function key (1-10)
4230   IF TCKI>58 AND TCKI<69 THEN TCKI=TCKI-58: FKEY=TCKI
4240 '** Following statement is used in field processing (see next issue)
```

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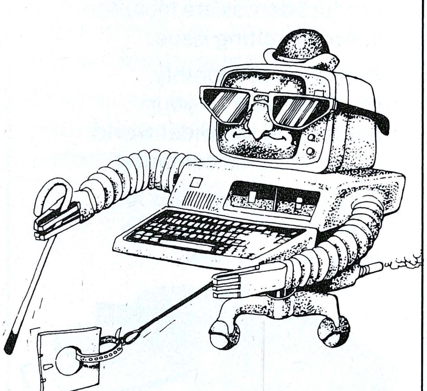

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```
4250   IF CKFIELD.SW AND INSTR(SPECIAL$,CK$)>0 GOTO 4320
4260  '** Test array of allowable special keys
4270   FOR TI=1 TO FKEYS
4280     IF TCKI=FKEY.A(TI) GOTO 4320
4290   NEXT
4300  '** IF you reach here, it was an illegal key
4310   SOUND 50,4: GOTO 4050                              '-tone to signal a bad key
4320 RETURN
4330 '
5000                  ' *** **************
5010                  ' ***  CKFIELD  ***
5020                  ' *** **************
5030 '
5040   IF INKEY$ < > "" GOTO 5040                            '-clear keystroke buffer
5050   CKFIELD.SW=TRUE: INS=FALSE                            '-initialize switches
5060   CKMAX=F.FL+1:   KHIT=0:   CN=1                        '   and variables
5070   LOCATE F.ROW,F.COL,1                                 '-place cursor at start of field
5080 '**---keystroke processing loop---**
5090   LOCATE F.ROW,F.COL+CN-1,1                            '-place cursor at current position
5100   GOSUB 4060                                            '-call CKKEY at 5050
5110   KHIT=KHIT+1                                           '-increment KHIT
5120   IF TCKI>0 GOTO 5300                                   '-test for special key
5130     IF CK>31 AND CN<CKMAX GOTO 5190                     '-test for normal key
5140     IF CK$=ENTER$ OR CK$=RTAB$ GOTO 5400                '-Enter key?
5150     IF CK$=BKSPC$ GOTO 5470                             '-Backspace key?
5160     IF CK$=ESC$ THEN KHIT=2: GOTO 5420                  '-Escape key?
5170    BEEP: KHIT=KHIT-1: GOTO 5100    '-Unknown key, should never get here
5180    '**--normal keys--**
5190     IF INS GOTO 5220                                    '-if inserting then go
5200       PRINT CK$;: CN=CN+1: GOTO 5100                    '-print key, inc position
5210    '**--inserting--**
5220     IF MID$(F.FIELD$,F.FL,1)< > " " GOTO 5280           '-can we insert?
5230     '**--insert key--**
5240      MID$(F.FIELD$,CN,F.FL-CN+1) = CK$ + MID$(F.FIELD$,CN,F.FL-CN)
5250      LOCATE ,F.COL,0: PRINT LEFT$(F.FIELD$,F.FL);: CN=CN+1
5260 GOTO 5090
5270 '***---error beep---***
5280  SOUND 50,4: GOTO 5100
5290 '*** TCKI>0
5300  IF NOT INS GOTO 5330                                  '-Inserting?
5310  IF TCKI=82 GOTO 5620                                   '-Insert key?
5320    INS=FALSE: LOCATE ,,1,2,10
5330  IF TCKI<75 GOTO 5400                                   '-non-special key?
5340  ON TCKI-74 GOTO 5470, 5400, 5500, 5400, 5680, 5400, 5400, 5620, 5570
5350                     '75         77         79              82   83
5360                     '<-         ->        END             Ins  Del
5370  IF TCKI=117 GOTO 5540                                  '-Control -End
5380  IF TCKI=115 THEN CN=1. GOTO 5090                       '-Control -Leftcursor
5390 '***---EXIT---***
5400  LOCATE ,,0,2,10: GOSUB 5740                            '-Get field from screen
5410  CKFIELD$=LEFT$(F.FIELD$,F.FL)                          '-Store in ckfield$
5420  CKFIELD.SW=FALSE                                       '-Turn off field switch
5430 RETURN '-------------------- R E T U R N --------------------
5440 '
5450 '*** Leftcursor - move cursor left within field      ***
5460                'if cn = 1 then can't go left, buzz ***
5470    IF CN>1 THEN CN=CN-1: GOTO 5520 ELSE GOTO 5280
5480 '*** Rightcursor - move cursor right within field     ***
5490               'if cn>=ckmax then can't go right, buzz ***
5500    IF CN<CKMAX-1 THEN CN=CN+1: GOTO 5520 ELSE GOTO 5280
5510  '*** Drop keys
5520  IF INKEY$><"" GOTO 5520 ELSE GOTO 5090
5530 '*** Control-End - erase field from above cursor and to the right ***
5540    LOCATE ,,0: PRINT SPC(F.FL-CN+1);
5550 GOTO 5090
5560 '*** Delete - delete character above cursor, shift remaining field to left
5570    ISTART=CN+1: T2=F.FL-CN
5580    IF T2>0 THEN GOSUB 5770                      '-Get part of field from screen
5590    PRINT MID$(F.FIELD$,ISTART,F.FL-CN+1);" ";
5600 GOTO 5090
5610 '*** Insert - get into or out of insert mode
5620    IF INS THEN LOCATE ,,,2,10: INS=FALSE: GOTO 5100
5630    '**--Set cursor depending on display type--**
5640    IF DISPLAY=1 THEN LOCATE ,,,10,3 ELSE LOCATE ,,,6,1
5650    INS=TRUE: GOSUB 5740
5660 GOTO 5090
5670 '*** End - move cursor past last nonblank character
5680    GOSUB 5740                                   '-Get field
5690    FOR CN=F.FL TO 1 STEP -1                     '-Find last non blank
5700      IF MID$(F.FIELD$,CN,1)< > " " GOTO 5720
5710    NEXT
5720    IF CN < > F.FL THEN CN=CN+1
5730 GOTO 5090
5740 '***---get field from screen 1 byte at a time using SCREEN function---***
5750 '***---if entering at line 5770, ISTART is set to position in field---***
5760   ISTART=1
5770   LOCATE ,,0                                    '-Turn cursor off
5780   FOR I1=ISTART TO F.FL                         '-Get field, one byte at a time
5790     MID$(F.FIELD$,I1,1)=CHR$(SCREEN(F.ROW,F.COL+I1-1))
5800   NEXT
5810 RETURN
```

▲

From Basic to Hex, or Keeping the Curse Off

Assembly Language Subroutines III

by Peter Baenziger

It's become fashionable to find fault with Basic: its lack of structure, its line numbers, and its slowness. Nevertheless, in sheer number of users it is probably the most popular computer language. And for good reason: It's available at little or no cost on most microcomputers, and it is a fast and forgiving language!

This last statement may need a bit of explaining. Basic fast? It obviously doesn't run very fast. Even compiled Basic is far from a speed demon. But it is a very quick language for the development of small to medium-sized programs. And it is forgiving, because the familiar "Syntax error" lets you know quickly when you've made a typo. Its lack of structure can also be considered an asset, because it allows you to think like a human being—relatively disorganized—rather than forcing you into a rigid computer mold.

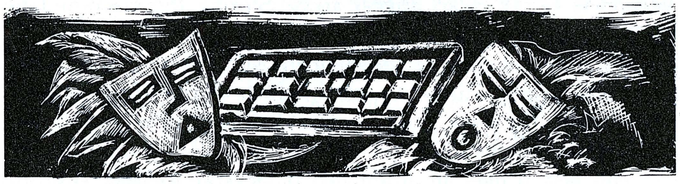
Compare program development in Basic with program development in a typical compiled language or assembly language. Regardless of language, you obviously will first think about the program, jot down some notes, and maybe make some diagrams. In Basic you then start entering the code, using the built-in screen editor. As soon as you've finished typing (or even before) you can test-run the program to catch and fix up the typing or logical errors that invariably creep in. It may not always be *quite* this easy; big logical errors may require a total rewrite of the program. But in any case, you never have to leave Basic, and the development process is a smooth cycle of thinking, coding, debugging, and back to thinking.

When you use assembly language or a compiled language (with the notable exception of Forth), you have to first load a text editor or word processor and type in the source code. Then you leave the editor and get the assembler or compiler to process your source code. Since you're human, you're sure to have made some typing mistakes or maybe overlooked some of the more esoteric requirements of your assembler or compiler. If you're lucky, it'll let you know with a bunch of error messages; if not, it may give up. So now you can go back to the text editor, fix up the source, and give it another try. You can't leave this vicious circle until you've proven your typing skills to the computer.

When you finally succeed, you'll have several files that are useless without another program, the linker. If the linking works (it usually does) you'll finally have a program to test. Depending on circumstances, you do this by just running the program or by loading Debug to run the program. Either way, it'll most likely crash, putting you back to square one—to thinking and the text editor.

Admittedly, this comparison is a bit one-sided in favor of Basic. But it is quite accurate as far as *small* programs are concerned. And very few people write really large, complex programs in Basic.

In spite of its many virtues, Basic does have weaknesses. Some of them, such as the lack of local variables and byte-oriented data structures (other than strings), are inherent in the language. Others are just temporary implementation deficiencies—for example, Basic and BasicA 1.0's failure to send a carriage return to the printer without adding a line feed and the fact that it beeped when you tried to *lprint chr$(7)*.



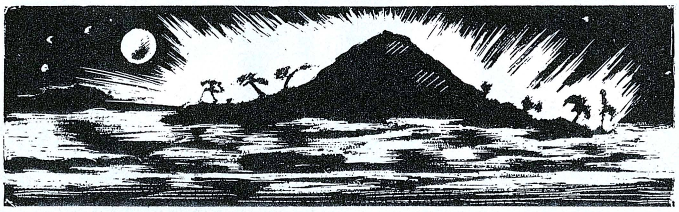
Whenever you come up against one of these limitations, you may think of a quick little machine language routine to solve the problem. You probably know enough about assembly language to write the code for most of the routine. In tricky spots you may have to consult a manual, such as *The 8086 Book* by Russell Rector and George Alexy (Osborne/McGraw-Hill). But all you want and need is a little fifty-to-seventy-byte routine, with maybe thirty instructions. Even with limited knowledge of assembly language, such a small undertaking shouldn't be too hard to master.

Except—as soon as you leave Basic, you're in the cycle of editor, assembler, linker, Debug, and back. Each one of these programs requires a fair amount of knowledge on your part. And some of the instruction manuals are far from clear. In short, you face a complex array of tools and instructions designed for major program development, not for your "quick" little subroutine.

Art by Weldon O. Lewin and Kevin McKeon

This article outlines a simple and standardized approach to integrating small machine language routines with Basic programs. It won't teach you assembly language programming, but you'll learn one way to connect a machine language routine to Basic. This system makes sense only for small subroutines; if your assembly code is much longer than about a typewritten page, you should use the "official" method of text editor, assembler, and linker. The article also assumes that you're reasonably familiar with Basic.

You need DOS 2.0 (particularly Debug 2.0) to make it work, because earlier versions of Debug didn't have a built-in miniassembler. DOS 2.0 unfortunately needs at least 96K of memory. Otherwise, there aren't any special requirements.



What makes this simplified approach different from the usual system? There aren't really any grand new ideas in it. It's just three minor simplifications that together add up to a significant speedup.

First, the actual assembly of the code is kept simple. Rather than "properly" assembling the routine, you just jot down the source code, then manually assemble it, using Debug 2.0. This method is quick and easy for small routines but obviously unsuited for larger machine excursions. The assembled code is written to disk as a binary file directly from Debug.

The second point is to standardize the storage and calling conventions. Basic offers two ways to connect a machine language routine (*usr* and *call*), and there are probably a dozen different methods to reserve memory for or store a routine. While the range of choices is nice, it also tends to make things complex.

So, to keep things simple, all routines are integrated with the Basic master program as *data* statements, and the actual run-time version is stored in an integer array. Storing the machine language routine within the Basic program does away with reserving memory and making sure that the subroutine file is on the right disk. The routines are *call*ed, which allows the passing of variables on the stack. Integer variables can also be passed in a few reserved elements of the array that holds the routine.

And last, it uses an automated binary-file-to-Basic subroutine conversion. The Basic program Bin2Data.bas (see listing 1) converts a binary file (as written by Debug) to a complete, ready-to-run Basic subroutine. This subroutine dimensions an array to the right size, restores the *data* pointer to the correct line, properly converts the machine language routine to *data* statements, and reads them into the array. Since the subroutine is an ASC file (the same kind you get with the ",A" option of the *save* command), it can be merged with any master Basic program.

We'll be using a sample assembly language subroutine to illustrate the various steps needed. It is a graphic printing subroutine that works with any dot-matrix printer capable of bit graphic printing. The fully commented listing (listing 2a) should explain its working. We won't discuss the routine itself, because it is just an example.

You may wonder why anybody would want to write such a routine. Why not just *lprint* the string? Because there seems to be an implementation deficiency in the new version 2.0 Basics. They can't send a control-Z (*asc* 26) to the printer. In normal text printing, this doesn't make any difference, because control-Z means end of file. In graphics printing, however, *asc* 26 is a valid three-dot pattern.

We'll first discuss how to connect a machine language routine to Basic and how we get from Basic to the routine and back. Then we'll go over how to use Debug to write and debug the routine. And finally we'll review the program Bin2Data.bas.

As mentioned before, there are several ways to integrate a machine language routine into a Basic program. The system discussed here reserves space for the routine within the Basic workspace by dimensioning an array large enough to hold the routine. When Bin2Data writes "*dim graphprt%(32)*" it is creating an integer array with thirty-three elements (remember element 0) of two bytes each. These sixty-six bytes are next to each other in memory, with Graphprt%(0) at the bottom and Graphprt%(32) at the top.

Basic sets each byte to 0 and then leaves the memory contents alone unless you assign a value to one of the elements. The Basic subroutine created by Bin2Data does just this: It assigns values read out of *data* statements to Graphprt%(4) to Graphprt%(32). These values *are* the machine language routine. The size of the array and the values read in would be different for another routine, but Bin2Data will always automatically make the array big enough.

The Basic function *varptr( )* lets you find out where in memory variables and elements of arrays are. For example, *varptr(graphprt%(4))* returns the address of array element 4. This happens to be the start of the printing routine. Graphprt%(0) to (3) are used to pass variables to the routine and will be discussed later.

How do you get from Basic to the machine language routine (and back)? As mentioned before, there are two major ways, the *usr* function and the *call*. Here we'll only discuss *call*. *Call* is the machine language equivalent of *gosub*. Within Basic you use the statement *gosub line number*. Basic then transfers control to the line number listed, does whatever the routine does, and returns when it encounters a *return* statement. Machine language routines can be *call*ed in a similar fashion: *call address*. In this case, you would call the routine like this:

```
ADDRESS=VARPTR(GRAPHPRT%(4)) ' Starting address
CALL ADDRESS                 ' of routine
```

Basic will transfer control to the routine starting at address; the routine will do its thing and then return to Basic by executing the machine language equivalent of *return*.

It's usually a good idea to update the address just before calling the routine. Basic shifts arrays around in memory every time your program creates a new simple variable. So the actual starting address of the routine may vary during the course of a program run.

One problem remains: Machine language doesn't understand Basic variables; it deals only in memory addresses and memory contents. The *call* statement solves this by letting you pass the addresses of Basic variables on the stack. You simply list one or more variables, like this:

```
CALL ADDRESS(GRAPHPRT%(0),GRAPH$)
```

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The addresses of Graphprt%(0) and Graph$ are now accessible to the machine language routine, and it can look up their values. It's obvious why we would want to pass the address of Graph$—these are the graphic bytes that we want to print. But why do we want to transfer the address of Graphprt%(0)?

It's a matter of convenience and simplicity. We can use Graphprt%(0) to (3) to transfer additional variables and constants. Transferring the addresses of variables by listing them after *call* is relatively cumbersome, because you transfer only the address of the variable. So your routine has to get the address off the stack, move it to some pointing register (usually BX or SI), and finally get the actual variable value. If there are more than one or two variables, this address shuffle may take up more bytes than the actual routine.

It is a lot simpler to transfer only the address of Graphprt%(0). Once the routine knows where element 0 is, it'll also know where Graphprt%(1), Graphprt%(2), and so on are: Each element is two bytes higher in memory than the previous one. So once you've gotten the address of Graphprt%(0) off the stack, you stuff it in BX and with

```
MOV WHEREEVER, [BX]         ;you get the value
                            ;of GRAPHPRT%(0)
MOV SOMEWHERE, [BX+02]      ;you get the value
                            ;of GRAPHPRT%(1) etc.
```

Similarly, if you want the routine to report back to Basic you can simply

```
MOV [BX+06], FROM WHEREEVER ;and Basic will then
                            ;be able to read the
                            ;value of
                            ;GRAPHPRT%(3).
```

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*Call*ed machine language routines all go through an opening and closing ritual before starting their real work. According to Appendix C of the IBM Basic manual, only the stack pointer (SP) and the four segment registers (CS,DS,SS,ES) need to be preserved for Basic. So if your routine manipulates any of these, you should first save them, then at the end restore them. All other registers can be used freely, according to the manual. However, the examples shown in the same manual also save the base pointer BP. Nobody seems to know for certain whether this is truly necessary. Since pushing and popping BP takes only microseconds and two bytes of code, it may be better to err on the safe side and save BP.

The next step usually is getting the addresses of variables off the stack. If you haven't worked a lot with stacks, they can be quite confusing. Not difficult, just hard to follow, because the way we talk about the stack and the way it is really arranged in memory are not the same. We say "pushing something on the top of the stack." Hearing this, you would think that the new something goes on top. It doesn't. It gets added at the bottom, because the real stack in memory grows downward. Pushing a byte on the stack *decreases* the stack pointer; the newly added byte or word is lower in memory than the previously added bytes.

When Basic pushes the addresses of variables on the stack, it proceeds from left to right. In our example, it first pushes the address of Graphprt%(0) on the stack, then the address of the string descriptor of Graph$. The variable first pushed will be *higher* in memory than the one pushed later. And both will be higher than the four bytes that make up the return address, which Basic pushes on the stack last, just before transferring control to the machine language subroutine. And finally, we start out the routine by pushing BP on the stack, adding another two bytes.

At this point, there are ten bytes connected with our routine on the stack. Lowest in memory, at the address to which the stack pointer points, is the saved value of BP. Two bytes higher is the offset return address. At stack pointer plus 4 is the segment return address. At plus 6, we find the address of the Graph$ string descriptor; and eight bytes up, the address of Graphprt%(0).

To get the arguments passed by Basic off the stack to where our routine wants them, we transfer the stack pointer to the base pointer, then use the base pointer plus an offset:

```
MOV BP, SP          ;Get stack pointer into base pointer,
                    ;because the 8088 doesn't allow us to
                    ;add an offset to the stack pointer.

MOV SI, [BP+06]     ;This moves the two bytes that are six
                    ;bytes up—the string descriptor of
                    ;Graph$.
```

The string descriptor consists of three bytes that "describe" the string: The first byte is the length of the string, and the second and third bytes are the actual address of the start of the string. In other words, the address on the stack (which we just moved into SI) is *not* the address of Graph$. It is the address where we can find the length and the actual address of the string. Since this particular routine isn't interested in the length of the string, we can skip over the first byte and get the actual, real address of Graph$ into SI by

```
MOV SI, [SI+01]    ;At the beginning, SI holds the address
                   ;of the string descriptor. Located at +1
                   ;is the real address which we move
                   ;into SI. At the end, SI holds the real
                   ;address of Graph$.
```

Getting the address of the integer variable Graphprt%(0) off the stack is simpler. Since Graphprt%(0) was pushed on the stack just before Graph$, it is higher in memory:

```
MOV BX, [BP+08]  ;Move the base address of the array
                 ;Graphprt% into BX, allowing us to get
                 ;at the variables stored in the
                 ;array elements just above
```

This completes the preparatory steps at the beginning of any routine: Save the old BP just in case, transfer the stack pointer to BP, and use BP to get the addresses off the stack.

At the end of the routine, we have to clean up the stack, because Basic expects an undisturbed stack. We first restore the old BP and then execute a "far return." In addition, we want to get rid of the addresses of the variables put on the stack. Since each address consists of two bytes, we have to dispose of two times the number of variables passed on the stack bytes. In this case, we have to get rid of four bytes. In code

```
POP BP       ;Restore old BP (gets rid of 2 bytes on stack)
RETF 04      ;Far return, uses both segment and offset
             ;address (4 bytes), plus 4 extra bytes
```

We've discussed how to *call* a machine language routine from Basic and what we have to do in the routine to make the *call* work. Now we can work our way through a sample session and finally quickly describe how Bin2Data.bas works.

After doing your thinking and planning and jotting down of the routine, you run Debug. It is most easily done by entering the file name of your future binary file after typing Debug—such as

```
A >DEBUG GRAPHPRT.BIN
```

If Graphprt.bin doesn't exist, Debug will respond with "File not found." This is quite okay, because Debug will remember this file name unless you overwrite it with an *N* (name) command. Debug's prompt is a hyphen.

You are now ready to assemble by typing an *A*. Debug will respond with a default address where you can start entering your code. All numbers in Debug are hexadecimal, but you don't really need to use a lot of numbers. If your code is correct, the next address will appear as soon as you hit enter. If you've made an error, it'll point out the likely error spot and repeat the same address. A typical interaction would go about like this (your part of the dialogue is underscored):

```
-A
  0B3D:0100 PUSH BP
  0B3D:0101 MOV BP,SP
  0B3D:0103 MOV SI,[BP+06]
  etc.
  0B3D:012F RETF 04
  0B3D:0132
```

Once you've finished writing the code, you just hit enter when the next address appears. This gets you out of the assemble mode. If you would like to review what you've assembled, you use the *U* command (unassemble). It's usually best to give a starting and ending address, but you can step through just using the default settings. *U* will show you the addresses, the machine code, and the assembly mnemonics.

```
-U 100 12F
0B3D:0100 55        PUSH      BP
```

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```
0B3D:0101 89E5     MOV     BP,SP
0B3D:0103 8B7606   MOV     SI,[BP+06]
etc.
0B3D:012F CA0400   RETF     0004
```

If you're satisfied with your code, you can write it to disk using the *W* command. First you have to tell Debug how long your routine is. The number of bytes is the blank address where you just hit enter at the end of assembly, minus the starting address (default 100). You have to enter this value in the CX register with the *RCX* (register CX) command. Debug responds with what's currently in CX and a colon on the following line. You type in the number of bytes to write, hit enter, type *W*, enter again, and you're done. To get out of Debug you type Q for quit.

```
    -RCX
    CX 0000
    :32
    -W
Writing 0032 bytes
    -Q

    A>
```

You now have your subroutine in binary form on disk and are ready to convert it to a Basic subroutine. To do this, you load BasicA and run Bin2Data.bas. Bin2Data will prompt you for five items: first, the name of the binary file. Bin2Data will check if this file exists; if it doesn't it won't accept the file name. However, it cannot know whether the file is truly a binary file.

Next, you'll be prompted for the starting array element number (in case you want to use the first few elements to transfer data). Then you can select the starting line number for the Basic subroutine in the range of 10000 to 32000 and whether you want decimal or hexadecimal output. Finally you'll have to enter the name of the output file. If it already exists, you'll get a warning and can either erase it or change your file name. Every input item, except for the input file, has a default value.

Once you've entered the five pieces of information, you can either go back to change any of them or press F1 to start the conversion. The conversion is quite quick, a typical little subroutine taking only a few seconds. While writing the routine to disk, Bin2Data also displays it on the screen. See listing 2b for a typical output file.

If you're converting a binary or .COM file not written by Debug 2.0, the length of the file stored in the disk directory may not be the exact length of the file. CP/M-derived programs and also DOS 1.1 programs store the length of file in multiples of 128 bytes. Bin2Data will then dimension an oversize array and fill it at the end with garbage—usually all zeroes. No harm is done, except for some wasted memory, because subroutines all end with a RETF instruction. You can manually edit out the useless stuff.

You're now ready to merge the output file with your master program. You load your program, then type: *merge "graphprt.asc*. You probably should immediately save the new combined program before debugging or trying to run it. If you haven't done so yet, you should also insert a *gosub* to the routine you just merged.

Debugging the combined program can be tricky. The easiest way is to create first a debugging version of your subroutine. The 8088 processor in the IBM pc has a special interrupt, INT 3, which Debug uses for single stepping. In other words, as soon as Debug encounters the byte CCH (which is INT 3) it stops running the program, displays the registers and flags, and waits for your input.

If you insert such a byte at the beginning of your routine, you can then examine your routine at leisure. There are two ways to insert a CCH byte. You can actually insert an extra INT 3 ahead of your routine, then assemble a special debugging subroutine, write it to disk, convert it to a Basic subroutine and merge it with your master program—all the same steps as with the real routine.

A quicker but trickier way is to change the first *data* statement in the Basic subroutine. If your *data* statements are in hexadecimal, the first instruction byte is the third and fourth number in the first *data* statement. In the example routine, the first *data* is &H8955. The &H55 part is the first byte of the routine (PUSH BP). If you change this to &HCC (&H89CC) you've inserted an INT 3 at the beginning of your routine. When the program stops just before INT 3, you can then change it back to its original value. Normally Debug does this inserting and the restoring automatically. But since we won't know where in memory the routine will be, we can't use Debug's normal break points.

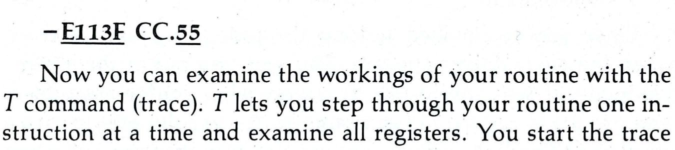
You may want to add one special Basic statement to your Basic master program: *locate ,,1*. This turns the cursor on even while the program is running. Without it you won't have a cursor when the program stops at INT 3. See listing 2c for a Debug version of the sample routine. The interaction goes as follows:

```
    A > DEBUG BASICA.COM
                              (G is the go command)
  -G
```

At this point you're in Basic. For Debug, Basic is just another program. Once you give the *G* command, Basic will be running almost normally. You can now load your program, change the first byte to CC, and then run it. Once it gets to the machine language subroutine, the INT 3 will drop you back into Debug. You'll see a display of all the registers, flags, and what and where the next instruction is:

```
AX=5DE9  BX=10B0     CX=0020  DX=1130
SP=FFF6  BP=1130     SI=1130  DI=04A5
DS=10C4  ES=10C4     SS=10C4  CS=10C4
IP=113F  NV UP EI PL ZR NA PE NC
10C4:113F CC          INT      3
```

If you've assembled a special debugging subroutine, your real routine starts at the instruction after INT 3, at 1140 hex in the example. If you've inserted the INT 3 byte instead of the first byte, you first should change it back. You do this with the *E* (enter) command. You type *E113F* (the location of the byte you want to change), and Debug prints CC. (the present value); you type the new value, 55, and your routine is back to normal.



```
  -E113F CC.55
```

Now you can examine the workings of your routine with the *T* command (trace). *T* lets you step through your routine one instruction at a time and examine all registers. You start the trace by typing *T=1140* or *T=113F* as appropriate, after the hyphen prompt. The equal sign is necessary; without it Debug will try to trace that many steps rather than trace one step starting at the given address. For later steps you just have to type *T*, unless you want to skip part of your routine.

It's best to "properly" return to Basic with the cleaned-up stack. This means popping BP if you've pushed it and using the RETF 04 instruction at the end of your routine. If you just quit Debug, without returning to Basic, you should reboot your system, or other programs that you load later may crash. After you've returned to Basic, the *system* command will return you not to DOS but to Debug. If you type Q at this point, all will be okay.

To get a hard copy of your assembly routine, you can use the control-printscreen key. For example, you can unassemble your routine (*U 100 13B* – address of first and last instruction), then press control-printscreen before hitting the enter key. Don't forget to press it again at the end of the listing, or you'll continue sending everything to the printer.

You can also create a listing file by using I/O redirection. DOS 2.0 allows you to send the output of a program, such as Debug, to a file rather than to the screen. When you do this, *all* output will go to the file and you'll be typing blind. This can work if you just want to enter a simple unassemble command and then quit. If you want a record file of a more complex interaction, it is probably best to also redirect input. For this, you have to first write a little file of the commands, one command to a line. Then you invoke Debug in the following manner:

```
DEBUG SUBR.BIN    <INPUT.DOC> OUTPUT.DOC
```

Debug will now read the commands in Input.doc as if you were typing them at the keyboard and send all the output not to the screen but to Output.doc. Except for the grinding of the disk drives, nothing will seem to happen: The cursor will just sit there until Debug is done. If you check the directory, you'll find a new file Output.doc. Listing 2a was prepared this way. The comments were typed in later, of course.

With this you should have all the tools needed to write your own assembly language subroutines and successfully connect them to Basic. You use Debug to assemble the code and write a binary file. Bin2Data converts it to a Basic loading subroutine. It dimensions an integer array large enough to hold the routine, then reads in the actual routine from *data* statements. The main program has to have a *gosub* to this loading routine.

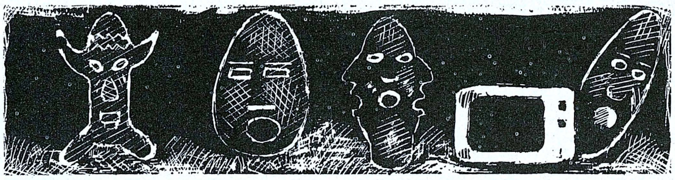
Once the routine is loaded, you can *call* it whenever you want to by finding the starting address, using Varptr(). Variables can be passed from Basic by listing them in parentheses after the *call*; then their addresses are passed on the stack. This is the best way for string and noninteger variables. Integer variables may be more easily transferred in some reserved elements of the same array that holds the machine language routine.

Bin2Data has two major parts—the actual conversion routine (lines 5000+) and the getting setup and getting input section. The input section is quite elaborate, because you'll be using Bin2Data infrequently. In other words, you may not remember every detail about the running of the program between uses.

We start out by declaring all variables as integer variables and setting the screen to the correct mode. The program then goes to the initialization subroutine at 3000+. We assign values to constants and dimension arrays, read in *data* and print the input screen. The coding is quite straightforward. The descriptive variable names or the comments should explain what is happening.

In line 190 we declare a subroutine target line for the F1 key, but don't turn it on yet. Line 200 does the same thing for F10, but this key is turned on. After a key is turned on, you can press it any time when the program is running and Basic will jump to the specified subroutine line—in the case of F10, to the end of the program. F10 is the emergency escape, for use when you find out that something is going wrong. F1 will be turned on later, after all the input has been checked out (line 350).

Next comes the input control loop. It's a simple *for . . . next* loop that steps through the five input items. In line 240 we set the cursor position (CP) to 0 and the text length (TL) to however long the answer ANS$(IT) is. The first time through it will be also 0. We then *gosub* to the input routine in line 2000. This routine allows full cursor movements in the answer field (insert, delete, backspace), converts all lowercase letters to uppercase, can limit the input to numbers only (if Num(it) is 1), screens out unwanted codes (such as escape or control-home) and only returns when you press enter.



You could replace the input routine with *line input* statements to shorten the program. However, the editor module is quite general and independent and can be useful in other programs. Full editing capability makes input a lot friendlier and more foolproof.

After an answer has been collected by the input routine, it gets sent to the checkout routines. If the input isn't okay, these routines set the NG (no good) flag. The checkout routines also substitute default values for an empty string where appropriate. We then print or reprint the answer, in high light color if it's okay, regular otherwise. We also clear off any remnants of a longer previous answer by reprinting the blank input field from the end of the word to the end of the field (line 300). If the answer isn't okay, we make a distinctive sound, then go back to the top (line 240) without advancing the loop.

Once all the input data has been gathered and checked out, we turn on F1 and print a message that it is okay to press F1 now (or to go back for corrections). Any key other than F1 (or F10, of course) will send you back to the top for another go through the loop. F1 will transfer you to the actual conversion routine.

Some quick comments on the checkout routines: The file names aren't checked out directly; we let a Basic error occur and then trap it. Depending on the error (you'll find a complete list in the back of the Basic manual) we print a message and then go back. When we check out the output file name (line 1400), an "error" of file not found really isn't an error as far as the program is concerned. We do not want to find a preexisting file name. It's when *no* error occurs (a file with the same name already exists) that we have a potential problem and print a warning message.

If you decide to replace the input routine at 2000+ with *line input* statements, you have to make the checkout routine more rigorous. *Line input* allows inputs of any length, doesn't convert lowercase to uppercase, and can't check for numeric-only input. For example, the starting array element check (line 1190) doesn't check anything because you can only enter valid data.

The conversion routine starts with a *return 5020* to the next following line. This clears the Basic subroutine stack and reactivates the F1 key. The interrupt keys are always turned off by Basic while it is in a subroutine called by the key. The key is immediately turned off again and only turned back on in line 5170. We also point it to a new subroutine, one that temporarily halts the conversion to give you a chance to study the output on the screen.

Lines 5020 to 5080 convert the input strings Ans$(it) to the appropriate forms for the conversion routine. Lines 5110 to 5170

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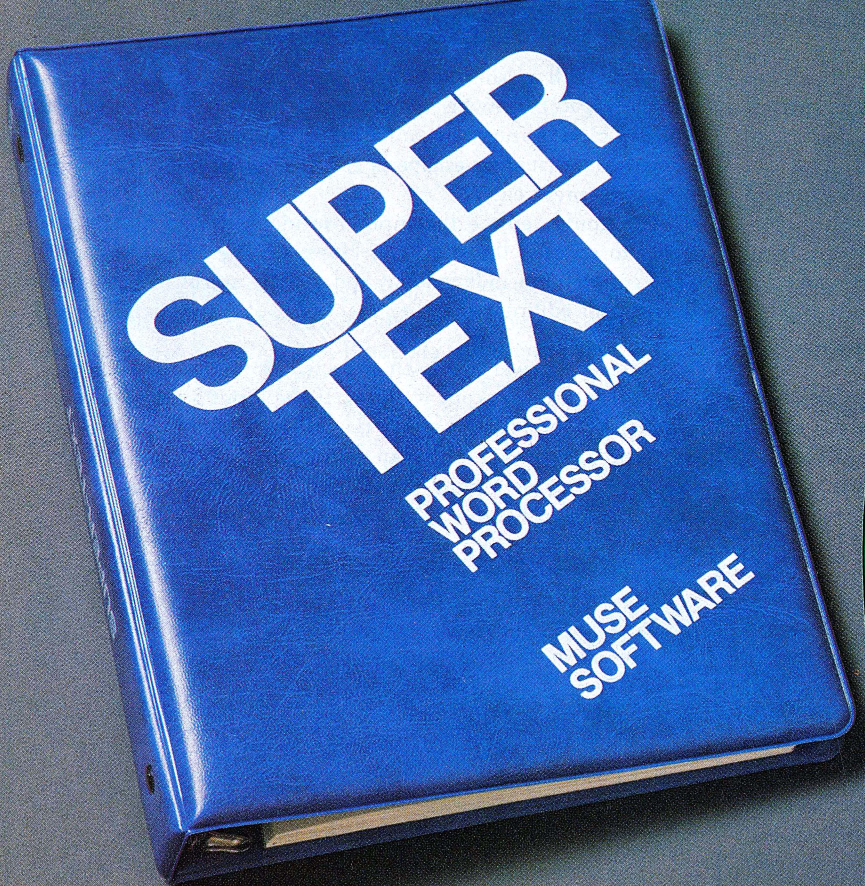
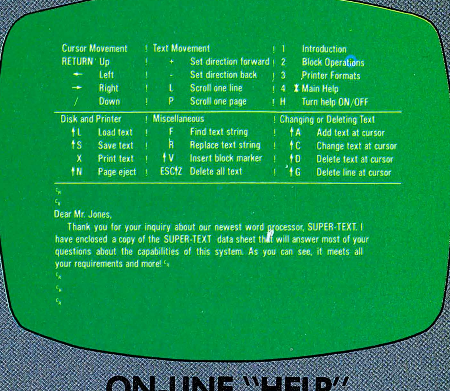
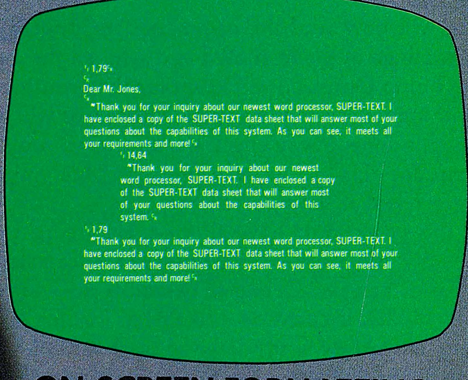




```
Cursor Movement   ! Text Movement               ! 1     Introduction
RETURN' Up        !     +   Set direction forward ! 2     Block Operations
  ←     Left      !     -   Set direction back  ! 3     Printer Formats
  →     Right     !     L   Scroll one line     ! 4   X Main Help
  /     Down      !     P   Scroll one page     ! H     Turn help ON/OFF
---------------------------------------------------------------------------
Disk and Printer  ! Miscellaneous               ! Changing or Deleting Text
  ↑L    Load text !     F   Find text string    !   ↑A    Add text at cursor
  ↑S    Save text !     R   Replace text string !   ↑C    Change text at cursor
  X     Print text!    ↑V   Insert block marker !   ↑D    Delete text at cursor
  ↑N    Page eject!  ESC↑Z  Delete all text     !   ↑G    Delete line at cursor
---------------------------------------------------------------------------
␍
␍
Dear Mr. Jones,
    Thank you for your inquiry about our newest word processor, SUPER-TEXT. I
have enclosed  a copy of the SUPER-TEXT  data sheet that will answer most of your
questions about the capabilities of this system. As you can see, it meets all
your requirements and more! ␍
␍
␍
␍
```

ON-LINE "HELP"



```
FI 1,79␍
␍
Dear Mr. Jones,
␍
  "Thank you for your inquiry about our newest word processor, SUPER-TEXT. I
have enclosed a copy of the SUPER-TEXT  data sheet that will answer most of your
questions about the capabilities of this system. As you can see, it meets all
your requirements and more! ␍
            FI 14,64
              "Thank you for your inquiry about our newest
            word processor, SUPER-TEXT. I have enclosed a copy
            of the SUPER-TEXT data sheet that will answer most
            of your questions about the capabilities of this
            system. ␍
FI 1,79
  "Thank you for your inquiry about our newest word processor, SUPER-TEXT. I
have enclosed a copy of the SUPER-TEXT  data sheet that will answer most of your
questions about the capabilities of this system. As you can see, it meets all
your requirements and more! ␍
```

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open the input file as a random access file and the output file as a sequential output file. We can't open the input file as a sequential file because Basic stops processing sequential files as soon as it encounters a control-Z (*asc* 26). Binary files, however, may contain control-Z anywhere in the file. We *get* the binary data in sixteen-byte (Recsize) chunks—just enough to fill one line of a Basic *data* statement.

Lines 5190 to 5230 assemble the subroutine Basic statements. It's a straightforward hooking together of various parts of strings, then writing them to disk. If you compare the program to the output in listing 2b you should find it quite easy to follow.

The only tricky part may be the *fns$((lof(1)\2)+(lof(1) mod 2) +astart−1)*—the size of the array. The function *fns$()* converts numbers to strings without the leading blank space that Basic inserts for positive numbers. It's defined on line 3100 in the initialization section. *(Lof(1)\2)* is half the length of the file, using integer division, which gives results only in whole numbers. The array holding your routine is half the length of the binary file, because each array element holds two bytes—except when the binary file has an odd number of bytes. The term *(lof(1) mod 2)* adjusts the array size for odd-length files. *Mod* stands for *modulo* and gives the remainder left after an integer division, in this case 1 if odd, 0 if even. *Astart* is where you want your routine to start in the array and −1 is there because arrays normally start with element 0.

Lines 5250 to 5340 assemble complete lines of *data* statements, lines 5360 to 5460 take care of the final shorter line and a possible final odd byte. The logic for both is pretty much the same and quite simple. The complexity comes only from making sure that we convert all bytes under all possible circumstances.

We always first assemble a Basic line number (5270 or 5370). Then we convert two bytes or one byte of binary data to an integer (5310, 5410 or 5450). The subroutine at 5520 converts the integer to a properly formatted decimal or hexadecimal string and adds it to the program string Prog$. Once a complete line has been assembled, it gets written to disk and screen by the routine at 5600.

The F1 interrupt routine at 9000+ lets you temporarily halt the program so that you can examine the output on the screen. Since the interrupt can occur at any time, we have to save the old cursor position and restore it before returning.

To save you the labor of typing Bin2Data.bas, send $8 to Softalk Bin2Data, Box 60, North Hollywood, CA 91603.

```
10   ' ***** BIN2DATA - Binary File Conversion *****
20   '
30   ' Version 2, Jul/Aug 1983
40   ' Peter Baenziger, 1215 Lane Blvd., Kalamazoo, MI 49001 (616) 349-2061
50   '
60   ' This program reads a binary file on disk and converts it to Basic
70   ' DATA statements in decimal or hexadecimal. It also creates the
80   ' code to read the DATA into an integer array with the same name as
90   ' the binary file. The Basic subroutine is saved on disk ready for
100  ' merging with a main program
110  '
120  ' Requires IBM PC, 1 disk, 80-column display, either adapter, BASICA
130  '
140  ' DEFINT A-Z
150  SCREEN 0:WIDTH 80:KEY OFF:COLOR 7,0:LOCATE ,,0
160  '
170  GOSUB 3000 ' Initialize and print screen
180  '
190  ON KEY(1) GOSUB 5000 ' Exit from input loop, do the conversion
200  ON KEY(10) GOSUB 10000:KEY(10) ON ' Quit
210  '
220  IFLAG=FALSE 'Clear insert mode flag
230  FOR IT=0 TO MAXIT
240    CP=0:TL=LEN(ANS$(IT)) ' Current cursor position & text length
250    GOSUB 2000 ' Input routine
260    NG=FALSE ' Clear no good flag
270    ON IT+1 GOSUB 1000,1190,1240,1300,1370 ' Checkout routines
280    IF NG=FALSE THEN COLOR 15,0 ' Highlight if ok
290    LOCATE YLOC(IT),LMARGIN,0:PRINT ANS$(IT);
300    COLOR 7,0:PRINT STRING$(ALEN(IT)-LEN(ANS$(IT)),BL); ' Clear end of answer field
310    IF NG THEN SOUND 2000,1:SOUND 800,1:SOUND 2000,1:GOTO 240 ' Didn't check out
320  NEXT
330  '
340  LIN25MSG$="Press F1 if ready to start the conversion, any other key to go back"
350  GOSUB 3600:SOUND 2000,2:KEY(1) ON ' Print go-ahead message
360  K$=INKEY$:IF K$="" THEN 360
370  GOSUB 3640:KEY(1) OFF ' Return for changes & clear off go-ahead message
380  GOTO 230
970  '
980  ' **** Input filespec check
990  '
1000 IF TL=0 THEN NG=TRUE:RETURN ' No default
1010 IF INSTR(ANS$(0),".")=0 THEN ANS$(0)=ANS$(0)+".BIN" ' Add default ext
1020 ON ERROR GOTO 1090 ' Error trapping
1030 OPEN "I",1,ANS$(0)
1040 DEFAULT$(4)=LEFT$(ANS$(0),INSTR(ANS$(0),".")-1)+".ASC" ' Create default for output file
1050 ON ERROR GOTO 0:CLOSE:RETURN
1060 '
1070 ' **** Error handling for file spec
1080 '
1090 IF ERR=71 THEN LIN25MSG$="Disk drive doesn't respond—door open? No disk?":GOTO 1140
1100 IF ERR=53 OR ERR=76 THEN IF IT=4 AND ERL=1400 THEN RESUME 1490 ELSE LIN25MSG$=ANS$(0)+"
     not found":GOTO 1140 ' File not found, error for input file, ok  for output file
1110 IF ERR=52 OR ERR=64 THEN LIN25MSG$=ANS$(IT)+" is not an acceptable file name":GOTO 1140
1120 ON ERROR GOTO 0:END
1130 '
1140 SOUND 800,1:COLOR 31,0:GOSUB 3570 ' Temporary print
1150 NG=TRUE:IF IT=0 THEN RESUME NEXT ELSE RESUME 1050
1160 '
1170 ' **** Starting array element check
1180 '
1190 IF TL=0 THEN ANS$(1)=DEFAULT$(1)
1200 RETURN
1210 '
1220 ' **** Starting line number check
1230 '
1240 IF TL=0 THEN ANS$(2)=DEFAULT$(2):RETURN
1250 IF VAL(LEFT$(ANS$(2),2))  < 10 OR VAL(LEFT$(ANS$(2),2)) >32 THEN NG=TRUE:RETURN
1260 ANS$(2)=FNS$(VAL(LEFT$(ANS$(2),2))*1000):RETURN
1270 '
1280 ' **** Decimal or hexadecimal check
1290 '
1300 IF TL=0 THEN ANS$(3)=DEFAULT$(3):RETURN
1310 FIND=INSTR("HD",LEFT$(ANS$(3),1)):IF FIND=0 THEN NG=TRUE:RETURN
1320 IF FIND = 1 THEN ANS$(3)="HEXADECIMAL" ELSE ANS$(3)="DECIMAL"
1330 RETURN
1340 '
1350 ' **** Output filespec check
1360 '
1370 IF TL=0 THEN ANS$(4)=DEFAULT$(4)
1380 IF INSTR(ANS$(4),".")=0 THEN ANS$(4)=ANS$(4)+".ASC"
1390 ON ERROR GOTO 1090
1400 OPEN "I",1,ANS$(4)
1410 ON ERROR GOTO 0:CLOSE
1420 LIN25MSG$="File already exists—E to erase, any other key to go back"
1430 COLOR 31,0:GOSUB 3600:SOUND 800,1
1440 K$=INPUT$(1)
1450 GOSUB 3640 ' Clear off error message
1460 IF INSTR("Ee",K$) THEN CLOSE:KILL ANS$(4) ELSE NG=TRUE
1470 CLOSE:RETURN
1480 '
1490 ON ERROR GOTO 1090
1500 OPEN "O",1,ANS$(4)
1510 CLOSE:KILL ANS$(4)
1520 ON ERROR GOTO 0:RETURN
1970 '
1980 ' **** Text input routine
1990 '
2000 LOCATE YLOC(IT),LMARGIN+CP,1
2010 I$=INKEY$:IF I$="" THEN 2010 ELSE I=ASC(I$)
2020 IF I< 32 THEN 2170 ' Control codes
2030 IF CP=ALEN(IT) THEN SOUND 800,1:GOTO 2010 ' End of line
2040 IF NUM(IT) THEN IF I<48 OR I >57 THEN SOUND 800,1:GOTO 2010 ' Check for numeric input
2050 IF I >96 AND I<123 THEN I=I-32:I$=CHR$(I) ' Convert to upper case
2060 IF CP=>TL THEN PRINT I$;:ANS$(IT)=ANS$(IT)+SPACE$(CP-TL)+I$:CP=CP+1:TL=LEN(ANS$(IT)):GOTO
     2010 ' At end or beyond word
2070 IF IFLAG THEN 2120
2080 PRINT I$;: ANS$(IT)=LEFT$(ANS$(IT),CP)+I$+MID$(ANS$(IT),CP+2):CP=CP+1:GOTO 2010 ' Overtype
2090 '
2100 ' **** Insert mode
2110 '
2120 IF TL=ALEN(IT) THEN SOUND 800,1:GOTO 2010 ' No more space
2130 PRINT I$ MID$(ANS$(IT),CP+1);:ANS$(IT)=LEFT$(ANS$(IT),CP)+I$+MID$(ANS$(IT),CP+1):TL=TL+1:
     CP=CP+1:GOTO 2000
2140 '
2150 ' **** Control codes
2160 '
2170 IF I=0 THEN I=ASC(RIGHT$(I$,1)): GOTO 2280 ' Sort out PC 2 byte codes
2180 '
2190 IF I=CR THEN RETURN ' Enter — this is the exit from input routine
2200 '
2210 IF I< >BS THEN SOUND 800,1:GOTO 2010 ' Backspace
2220 IF CP >TL THEN CP=CP-1:GOTO 2000 ' Beyond text, just cursor left
2230 IF CP=0 THEN 2350 ' Delete routine
2240 TL=TL-1:CP=CP-1:LOCATE YLOC(IT),LMARGIN+CP,0:PRINT MID$(ANS$(IT),CP+2) BL$;:
     ANS$(IT)=LEFT$(ANS$(IT),CP)+MID$(ANS$(IT),CP+2):GOTO 2000
2250 '
2260 ' **** IBM PC 2 byte control codes
2270 '
2280 IF I< >RT THEN 2310 ' Cursor right
2290 IF CP< ALEN(IT)-1 THEN CP=CP+1:GOTO 2000 ELSE 2010
2300 '
2310 IF I < > LT THEN 2340 ' Cursor left
2320 IF CP THEN CP=CP-1:GOTO 2000 ELSE 2010
2330 '
2340 IF I< >DEL THEN 2380 ' Delete
2350 IF CP=>TL OR TL=0 THEN 2010 ' No action
2360 TL=TL-1:PRINT MID$(ANS$(IT),CP+2) BL$;:ANS$(IT)=LEFT$(ANS$(IT),CP)+MID$(ANS$(IT),CP+2):
     GOTO 2000
2370 '
2380 IF I < > SF THEN SOUND 800,1:GOTO 2010 ' Insert flag
2390 IF (CP=ALEN(IT) OR TL=ALEN(IT)) AND (IFLAG=0) THEN SOUND 800,1:GOTO 2010 ' No more space
2400 IFLAG=NOT IFLAG:LOCATE 25,72,0 ' Flip insert flag
2410 IF IFLAG THEN COLOR 0,7:PRINT "Insert";:COLOR 7,0 ELSE PRINT SPACE$(6);
2420 GOTO 2000
2970 '
2980 ' **** Initialize
2990 '
3000 TRUE=-1:FALSE=0
3010 RECSIZE=16:LPERSCRN=16:PROGL=5 ' Constants for actual conversion
3020 MAXIT=4 ' Number of items, counting from 0
3030 LT=75:RT=77:DEL=83:BS=8:CR=13:ISF=82 ' Control key codes
3040 PLMARGIN=2:BL=176:BL$=CHR$(BL) ' Prompt left margin and answer field blank
3050 '
3060 DIM ANS$(MAXIT),YLOC(MAXIT),ALEN(MAXIT),NUM(MAXIT),DEFAULT$(MAXIT) 'Arrays to hold
     input, line location, maximum input length, numeric only, default values
3070 '
3080 TITLE$="* Binary File to Basic Data Statements Conversion *"
3090 FRM$=STRING$(LEN(TITLE$),"*") ' Frame
3100 DEF FNS$(L)=MID$(STR$(L),2) ' Convert number to string without leading space
3110 '
```

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```
3120  GOSUB 3500 ' Clear screen & print heading
3130  FOR N=0 TO MAXIT
3140     READ PROMPT$,YLOC(N),ALEN(N),NUM(N),DEFAULT$(N)
3150     LOCATE YLOC(N),PLMARGIN,0:PRINT PROMPT$ SPC(2) STRING$(ALEN(N),BL)
3160     PRINT TAB(PLMARGIN) "Default " DEFAULT$(N)
3170  NEXT
3180  LMARGIN=PLMARGIN+LEN(PROMPT$)+2 ' Left margin of answer field
3190  LOCATE 22,PLMARGIN+4:PRINT "Right & left cursor keys, insert, delete and backspace are
      active."
3200  PRINT TAB(PLMARGIN+4) "<ENTER> alone enters the default value. Press F10 anytime to quit"
3210  RETURN
3220  '
3230  ' **** Data for prompts, locations
3240  ' PROMPT$,YLOC,ALEN,NUM,DEFAULT$
3250  '
3260  DATA "Filespec of binary file - D:PATH\NAME.EXT",7,32,0,"ext.= .BIN"
3270  DATA "Starting array element number    - 0 to 99",10,2,1,"0"
3280  DATA "Starting Basic line number - 10000 to 32000",13,5,1,"10000"
3290  DATA "Hex or decimal DATA statements   - H or D ",16,11,0,"HEXADECIMAL"
3300  DATA "File spec for Basic routine  -D:PATH\NAME.EXT",19,32,0,"Binary filespec + .ASC"
3470  '
3480  ' **** Print heading
3490  '
3500  CLS
3510  CPOS=(80-LEN(FRM$))\2:LOCATE 2,CPOS,0:PRINT FRM$
3520  PRINT TAB(CPOS) TITLE$:PRINT TAB(CPOS) FRM$
3530  RETURN
3540  '
3550  ' **** LIN25MSG$ print
3560  '
3570  GOSUB 3600:FOR DELAY=1 TO 1250:NEXT DELAY:GOSUB 3640 ' Temporary print
3580  RETURN
3590  '
3600  GOSUB 3640 ' Clear off old message
3610  LOCATE 25,(72-LEN(LIN25MSG$))\2,0:PRINT LIN25MSG$;:COLOR 7,0
3620  RETURN
3630  '
3640  LOCATE 25,1:PRINT SPACE$(71);:RETURN ' Clear prompt
4970  '
4980  ' **** F1 - Binary to DATA conversion
4990  '
5000  RETURN 5020 ' Exit from F1 interrupt subroutine
5010  '
5020  KEY(1) OFF:ASTART=VAL(ANS$(1)):BASLN=VAL(ANS$(2)) ' Convert answer strings to starting
      array element and starting Basic line number
5030  IF ANS$(3)="DECIMAL" THEN HEXA=FALSE ELSE HEXA=TRUE
5040  ARRAY$=LEFT$(ANS$(0),INSTR(ANS$(0),".")-1) ' Get rid of extension
5050  TEMP=LEN(ARRAY$)-8:IF TEMP<0 THEN TEMP=0 ' Starting point for parsing
5060  TEMP2=INSTR(TEMP+1,ARRAY$,"."):IF TEMP2 THEN TEMP=TEMP2 ' Find drive delimiter, if any
5070  TEMP2=INSTR(TEMP+1,ARRAY$,"\"):IF TEMP2 THEN TEMP=TEMP2:GOTO 5070 ' Find path delimiters,
      if any
5080  ARRAY$=MID$(ARRAY$,TEMP+1) ' Name of array
5090  LIN25MSG$="Press F1 to temporarily halt program, F10 to quit"
5100  '
5110  OPEN "R",1,ANS$(0),RECSIZE ' Binary input file
5120  FIELD #1, RECSIZE AS RD$
5130  NUMLIN=LOF(1)\RECSIZE:LASTLIN=LOF(1) MOD RECSIZE ' Number of DATA lines and size of last
      line
5140  OPEN "O",2,ANS$(4) 'ASC output file
5150  '
5160  GOSUB 3500:GOSUB 3600 ' Print heading & line 25 message
5170  ON KEY(1) GOSUB 9000:KEY(1) ON:LOCATE 7,1,0 ' Repoint F1 interrupt
5180  '
5190  PROG$=FNS$(BASLN)+" DIM "+ARRAY$+"%("+FNS$((LOF((1)\2+(LOF(1) MOD 2)+ASTART-1)+")":
      BASLN=BASLN+10:GOSUB 5600 ' Write first line to disk & screen
5200  PROG$=FNS$(BASLN)+" RESTORE" +STR$(BASLN+40):BASLN=BASLN+10:GOSUB 5600
5210  PROG$=FNS$(BASLN)+" FOR N%=" + FNS$(ASTART) + " TO " +FNS$((LOF(1)\2)+(LOF(1) MOD
      2)+ASTART-1) + ":READ " + ARRAY$ + "%(N%):NEXT":BASLN=BASLN+10:GOSUB 5600
5220  PROG$=FNS$(BASLN)+" RETURN":BASLN=BASLN+10:GOSUB 5600
5230  PROG$=FNS$(BASLN)+" '":BASLN=BASLN+10:GOSUB 5600
5240  '
5250  IF NUMLIN=0 THEN N=1:GOTO 5360 ' If there is only a single line
5260  FOR N=1 TO NUMLIN
5270     PROG$=FNS$(BASLN+((N-1)*10))+" DATA"  ' Line number
5280     GET 1
5290     MAX=RECSIZE
5300     FOR M=1 TO MAX STEP 2
5310          WORD=CVI(MID$(RD$,M,2)):GOSUB 5520 ' Convert two bytes
5320     NEXT
5330     GOSUB 5600 ' Write to disk & screen
5340  NEXT
5350  '
5360  IF LASTLIN =0 THEN 10000 ' Exit
5370  PROG$=FNS$(BASLN+((N-1)*10))+" DATA"
5380  GET 1
5390  MAX=LASTLIN AND 254:IF MAX=0 THEN 5430 ' Even MAX
5400  FOR M=1 TO MAX STEP 2
5410          WORD=CVI(MID$(RD$,M,2)):GOSUB 5520 ' Convert two bytes
5420  NEXT
5430  IF (LASTLIN AND 1)=0 THEN 5460 ' Skip if no odd last byte
5440  IF MAX THEN PROG$=PROG$+"," ' Add a comma separator if there were preceding DATA elements
5450  WORD=ASC(MID$(RD$,LASTLIN,1)):GOSUB 5520 ' Convert odd byte
5460  GOSUB 5600 ' Write to disk & screen
5470  '
5480  GOTO 10000 ' Done
5490  '
5500  ' **** Make DATA element
5510  '
5520  IF HEXA THEN WORD$="&H"+HEX$(WORD) ELSE WORD$=STR$(WORD)
5530  SAMESIZE$=SPACE$(7):RSET SAMESIZE$=WORD$
5540  PROG$=PROG$+SAMESIZE$
5550  IF M<MAX-1 THEN PROG$=PROG$+","
5560  RETURN
5570  '
5580  ' **** Write to disk & screen
5590  '
5600  PRINT #2, PROG$
5610  IF ((PROGL+N) MOD LPERSCRN) THEN PRINT PROG$:RETURN ' Screen not full
5620  GOSUB 3500:GOSUB 3600 ' Clear screen,print heading & line 25
5630  LOCATE 7,1:PRINT PROG$
5640  RETURN
8970  '
8980  ' **** F1 - temporary halt interrupt
8990  '
9000  OLDLIN=CSRLIN:OLDX=POS(1) ' Save cursor position
9010  LIN25MSG$="Press any key to go on":GOSUB 3600 ' Print new message
9020  LIN25MSG$="Press F1 to temporarily halt program, F10 to quit"
9030  K$=INPUT$(1):GOSUB 3600 ' Reprint old message
9040  LOCATE OLDLIN,OLDX:RETURN ' Reset cursor
9970  '
9980  ' **** End of program
9990  '
10000  CLOSE:KEY ON:END
```

Listing 2a. A Fully Commented Listing of the Sample Machine Language Subroutine.

```
                                  : ****  Graphic Printing Subroutine
                                  ;       July 83
                                  ;
                                  ;GRAPHPRT%(0) holds any special character, such as 3
                                  ;that have to be sent to the printer twice in order
                                  ;to be printed once
                                  ;GRAPHPRT%(1) holds the printer number - 0,1 or 2
                                  ;corresponding to LPT1, LPT2 or LPT3
                                  ;GRAPHPRT%(2) holds the number of bytes of GRAPH$
                                  ;that should be printed
                                  ;GRAPHPRT%(3) is set to 0 if printing was successful,
                                  ;nonzero if an error occurred, such as time out.
                                  ;GRAPHPRT%(4) is the start of the routine
                                  ;
08F7:0100  55               PUSH  BP                   ;Save the old value
08F7:0101  89E5             MOV   BP,SP                ;Move the stack pointer so
                                                       ;that we can play with it
08F7:0103  8B7606           MOV   SI,[BP+06]           ;Get the address of the string
                                                       ;descriptor of GRAPH$ into SI
08F7:0106  8B7401           MOV   SI,[SI+01]           ;Get the address of the string
08F7:0109  8B5E08           MOV   BX,[BP+08]           ;proper into SI
08F7:010C  8B5702           MOV   DX,[BX+02]           ;Get address of GRAPHPRT(0)
                                                       ;Move the actual value of
                                                       ;GRAPHPRT(1) into DX. This is
                                                       ;the printer number
08F7:010F  8B4F04           MOV   CX,[BX+04]           ;Move the actual value of
                                                       ;GRAPHPRT(2) into CX, for
                                                       ;counting down
08F7:0112  FC               CLD                        ;Set the direction flag to
                                                       ;increase SI every time we
                                                       ;LODSB
                                                       ;
08F7:0113  AC        GP1:   LODSB                      ;Load a byte from the string
                                                       ;pointed to by SI into AL
08F7:0114  E81B00           CALL  0132                 ;Call the print routine
08F7:0117  7512             JNZ   012B                 ;Quit if there was an error
08F7:0119  803F00           CMP   BYTE PTR [BX],00     ;See if the printer has a
                                                       ;special number that needs
                                                       ;printing twice (such as 3
                                                       ;for IDS printers)
08F7:011C  7409             JZ    0127                 ;Skip the double printing
                                                       ;routine if there isn't a
                                                       ;special number
                                                       ;
08F7:011E  3A07             CMP   AL,[BX]              ;Is the number we just printed
                                                       ;the same as the spec number?
08F7:0120  7505             JNZ   0127                 ;If not, skip the double print
08F7:0122  E80D00           CALL  0132                 ;If yes, print it again
08F7:0125  7504             JNZ   012B                 ;And quit if a print error
                                                       ;
08F7:0127  E2EA      GP2:   LOOP  0113                 ;Count down CX. If not zero
                                                       ;loop back to the top
08F7:0129  31C0             XOR   AX,AX                ;All went well, clear error
                                                       ;flag
08F7:012B  894706    GP3:   MOV   [BX+06],AX           ;Store the error flag in
                                                       ;GRAPHPRT(3) - 0 if all ok,
                                                       ;not 0 if an error happened
08F7:012E  5D               POP   BP                   ;Restore the old BP
08F7:012F  CA0400           RETF  0004                 ;Return back to Basic, but
                                                       ;first get rid of the 4 bytes
                                                       ;passed on the stack

                            ;
                            ;  *** Actual printing subroutine
                            ;
08F7:0132  30E4      GP4:   XOR   AH,AH                ;Clear AH.  0 AH indicates
                                                       ;printing to INT 17
08F7:0134  CD17             INT   17                   ;INT 17 is the BIOS printing
                                                       ;routine
08F7:0136  F6C429           TEST  AH;29                ;Set zero flag according to
                                                       ;outcome of printing, not 0
                                                       ;if not ok
08F7:0139  C3               RET                        ;And back
```

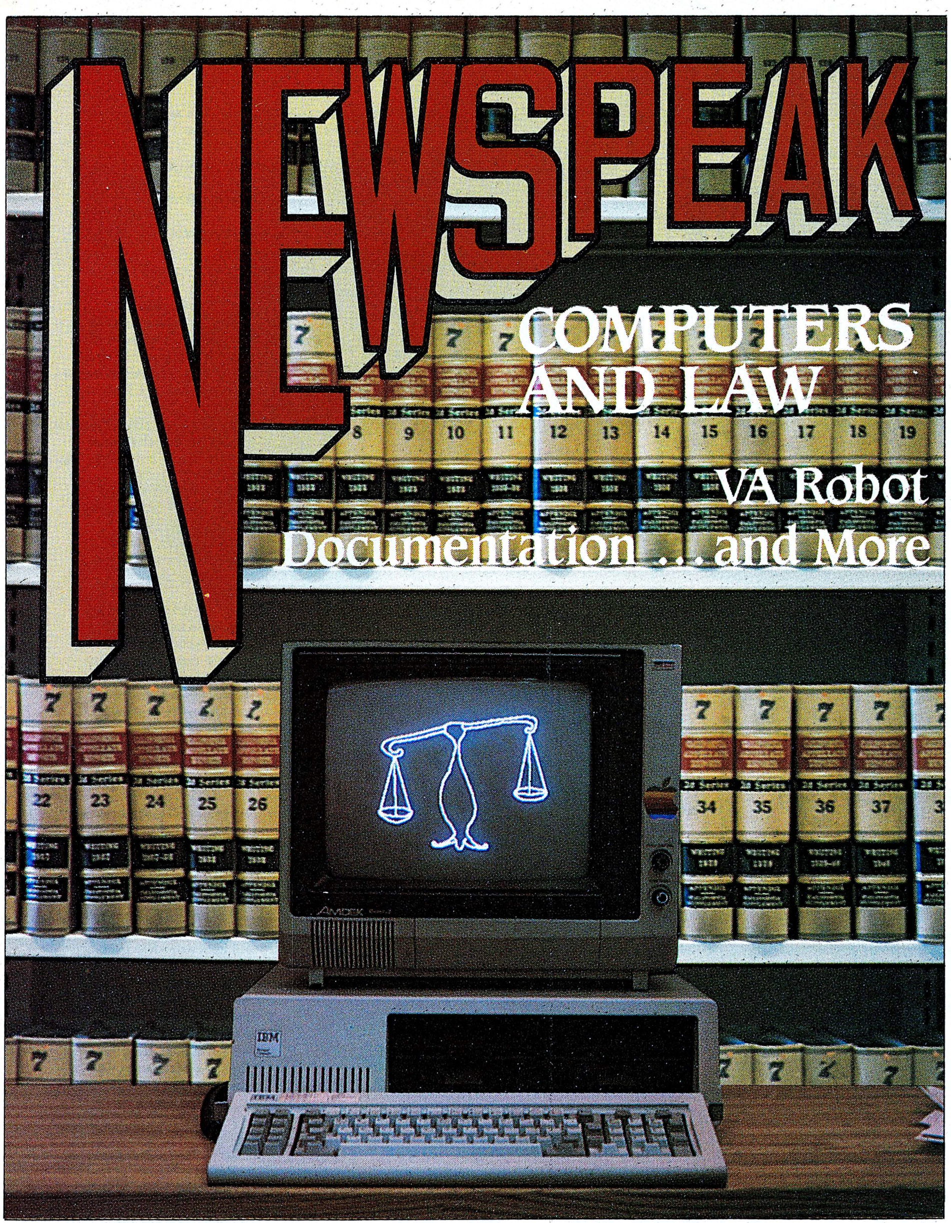
Listing 2b. Basic Subroutine Written by BIN2DATA

```
20000  DIM GRAPHPRT%(32)
20010  RESTORE 20050
20020  FOR N%=4 TO 32:READ GRAPHPRT%(N%):NEXT
20030  RETURN
20040  '
20050  DATA  &H8955, &H8BE5,   &H676, &H748B, &H8B01,   &H85E, &H578B,  &H8B02
20060  DATA   &H44F, &HACFC, &H1BE8, &H7500, &H8012,    &H3F,  &H974,   &H73A
20070  DATA   &H575,  &HDE8, &H7500, &HE204, &H31EA, &H89C0,   &H647, &HCA5D
20080  DATA     &H4, &HE430, &H17CD, &HC4F6, &HC329
```

Listing 2c. A Master Calling Program with Debugging Version of Subroutine.
In Line 20050 &H89CC Replaces the Original &H8955.

```
10   GOSUB 20000 ' Load machine language routine
20   GRAPH$=STRING$(40,65) ' Create a string for printing
30   GRAPHPRT%(0)=0 ' No special character required by printer
40   GRAPHPRT%(1)=0 ' Printer number, LPT1: is 0, LPT2: is 1 etc.
50   GRAPHPRT$(2)=20 ' Number of bytes to print out of GRAPH$
60   ADDR=VARPTR(GRAPHPRT%(4)) ' Get address of subroutine
70   CALL ADDR(GRAPHPRT%(0),GRAPH$) ' Do the subroutine
80   PRINT GRAPHPRT%(3) ' If all went well, it should be 0
90   END
100   '
20000  DIM GRAPHPRT%(32)
20010  RESTORE 20050
20020  FOR N%=4 TO 32:READ GRAPHPRT%(N%):NEXT
20030  RETURN
20040  '
20050  DATA &H89CC, &H8BE5,   &H676, &H748B, &H8B01,   &H85E, &H578B,  &H8B02
20060  DATA   &H44F, &HACFC, &H1BE8, &H7500, &H8012,    &H3F,  &H974,   &H73A
20070  DATA   &H575,  &HDE8, &H7500, &HE204, &H31EA, &H89C0,   &H647, &HCA5D
20080  DATA     &H4, &HE430, &H17CD, &HC4F6,   &H329
```

▲



COMPUTER/LAW CENTER FOCUSES ON MACHINES AND MAGISTRATES

Even more difficult than trying to keep up with the flood of new computer products and technology is trying to make sense of the legal aspects of the Information Age.

One has only to read the daily newspaper to realize how important the law is to the computer industry. Hardly a day passes where there isn't a story about software or hardware copyright infringements, contractual hassles, or just good old theft of corporate secrets.

The big question is, what is the law? If a law hasn't been written to handle a specific situation, then what does an individual or company do?

"The law usually trails industry by a generation," says Michael Scott, editor of *The Scott Report* and founder of the Center for Computer/Law in Manhattan Beach, California. "Currently, the courts are totally at sea and the only remedy is to go to Congress and make them clarify what the law is."

As confusing and distressing as the current situation is, some people are working to make it better. Scott is one of these, a sharp individual tackling one of the most challenging and volatile fields in the world today—computers and the law.

The Center for Computer/Law was founded in 1977 by Scott and a number of attorneys and law professors. It's a nonprofit institution focusing on the legal problems of the computer and telecommunications industries, a focal point for re-

GOTO page 172, column 2

RETURN OF THE CHIP INDUSTRY

As the recession ends and the economy recovers, the American semiconductor industry is getting back in stride.

The demand for computer chips has been rising sharply since early this spring, so much so that most chip manufacturers are having trouble meeting the increased demand. The delays in delivering chips to computer manufacturers have been getting longer and longer, and many chip makers are saying that they may have to restrict the amounts their customers can order.

The situation is great for the semiconductor industry—which struggled through two years of recession, closing down production lines and laying off many employees—but not so good for some computer manufacturers. In July, Intel Corporation reported that its second quarter net income had nearly tripled from a year earlier. Previously struggling National Semiconductor reported that its net income for the fourth quarter ending May 31 was more than double that of last year's fourth quarter.

The rise in demand and the shortage of product is giving the buyers of chips corporate migraines. Already some computer manufacturers are being forced to buy chips at inflated prices, and industry executives expect the situation to get worse before it gets better sometime next year. Industry scuttlebutt has it that Atari is hard put to meet its October 1 release date of the low-priced Atari 600XL because it can't get enough chips for the new machine.

The pressure caused by the chip shortage will be greatest on young computer companies lacking established relationships with chip makers. The shortage will surely muck up some computer manufacturers' holiday season plans.

Semiconductor industry executives say that computer makers alone aren't increasing the demand. The military establishment and the telecommunications, office automation, and automotive industries are also responsible for the increased demand. In the past six months, the market has changed, causing both chip makers and buyers to scramble to solve the problem.

In January of this year, buyers could expect delivery of many chips in a matter of days. Zilog, manufacturer of the Z-80

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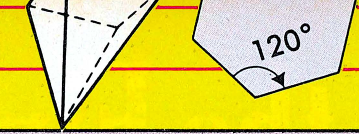
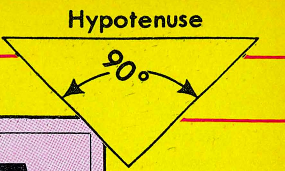
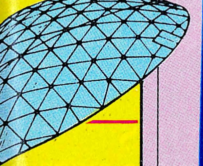
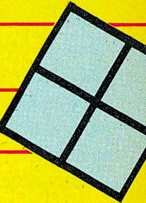








DOES YOUR CHILD NEED A MATH TUTOR?

The young mathematical geniuses whose tutoring talents could be had for five dollars an hour when we were struggling with our numbers are now off writing software, making thousands. What's a parent to do?

Why not try *Math Tutor*?

This public domain program can be used by elementary-school students as well as by older students who need math practice. It can generate thousands of different recallable tests and exercises.

The movement of a flashing cursor prompts the user to solve problems digit by digit. Cursor movement exactly duplicates the sequence that would be followed in solving a problem on paper. At the end of a problem series, an opportunity to solve missed problems is given. The program includes a time-limit feature.

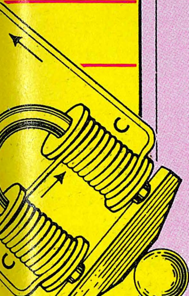
Math Tutor is self-documenting. The main menu includes instructions about the program itself, the keyboard setup, and how to work problems. Information on tests and exercises, test analysis, and the creation of special types of problems is also provided.

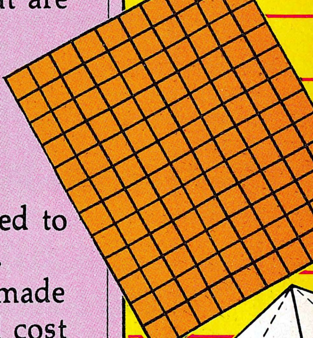
Math Tutor contains exercises and tests for the six elementary grades. You can use these as they are, or you can vary the parameters to create tests and exercises that are personalized in format, type, bounds, sequence, time, and duration.

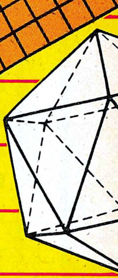
Math Tutor was written by Joseph Barteck. As an IBM employee, Barteck is not allowed to publish his program for profit. Therefore the program is being made available to you at the nominal cost of $8 to cover materials and handling. The author will donate any profits he would have received to a child-abuse prevention group.

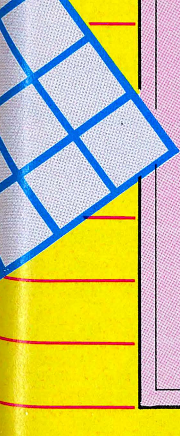
Math Tutor runs in Basic and requires 48K. The disk is copyable, which means you can store tutorial sequences on different copies of the original disk.

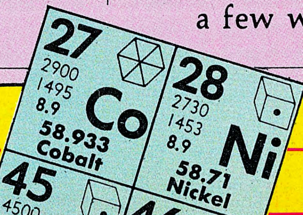
To obtain *Math Tutor*, send $8 to Math Tutor, Softalk for the IBM Personal Computer, Box 60, North Hollywood, CA 91603. Please allow a few weeks for delivery.











x2=4
x3=6
2x4=8

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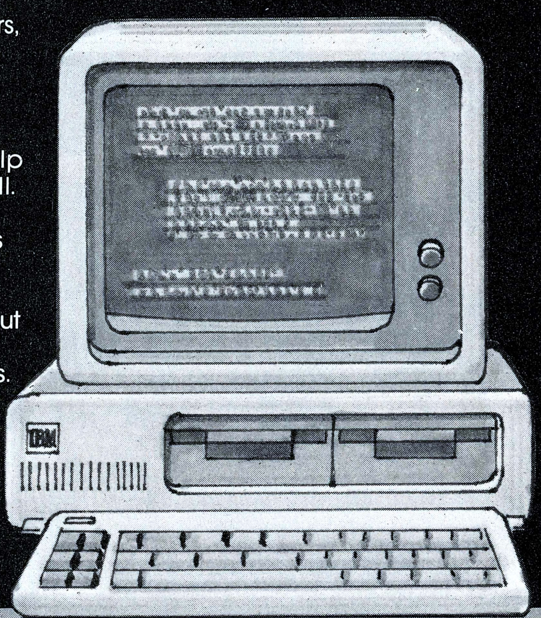

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CATALOG AVAILABLE

Veterans' Administration Customizes an Industrial Robot for the Handicapped

In the last decade, computers have lent their special talents to the handicapped and disabled. Today, robots are beginning to expand those talents even farther.

Some of the most promising work in the field of robotics for the handicapped is being done by the Veterans' Administration with the help of scientists and doctoral students at Stanford University.

"In identifying vocational task development needs, we went to C-4 quadriplegics (paralyzed below shoulder level) working in the community and asked them what they most needed to be able to do that they could not," recalls K.G. Englehardt, project evaluation supervisor and clinical director at the V.A. hospital in Palo Alto, California.

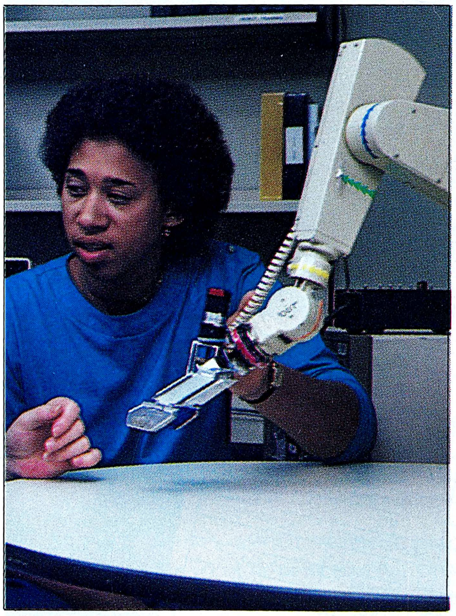
"The response was, 'Put a disk in a disk drive' and 'Open a file cabinet drawer, take out a file, and open it.' That was a surprise; those aren't the obvious things that you might suppose a severely disabled person would most need to do."

With those responses in mind, Stanford developed a voice-activated system that uses a modified Puma 250 industrial robot arm connected to a Zilog 80 computer, a Votrax voice synthesizer, and a Voterm voice-recognition device. Stanford associate professor of mechanical engineering Larry Leiffer, who worked on the design of the system, calls it a departure from the usual approach to high-tech aid for the handicapped in that the robot is not a replacement of a body part but a companion to the user, operated at a distance.

Currently, the robot arm can perform multiple tasks that are part of daily living, but the engineers still have to work on getting the robot to put a disk in a disk drive.

"At this stage, it's still not a turnkey system," says Englehardt, "though we're working to make it as accessible as possible, so that, ideally, a quadriplegic could just wheel up to it and get started right away."

After a year of intense interdisciplinary work, the research team has been able to reduce to about forty-five minutes the user training time necessary to instruct the robot in a simple action, such as getting a glass of water. Cooking (putting a prepackaged meal in an oven) and certain vocational tasks are currently within the robot's abilities, as are various recreations: The robot can wield a paintbrush and play board games, executing moves at the user's command. But the more complex tasks still take up to ten hours of training.



Operating the robot is more analogous to flying a spaceship than to driving a car, explains Englehardt. "You have forward, back, up, down, left, right, roll, pitch, and yaw." The manual is currently 190 pages in length.

Englehardt says the robot can now recognize fifty-eight spoken words, and the accuracy of the recognition has improved from 84 or 85 percent at the time the project started to about 95 percent.

Currently in a home with four quadriplegics, the robot arm will next go to a long-term-care facility for "task design," in which quadriplegics and attendants will identify applications and help design tasks for the robot to perform.

In the future, the Stanford team plans to add other senses besides hearing to the robot. A mobile base is under development, though it cannot be voice-controlled as yet and has not been a part of the V.A. clinical evaluation.

And when will the current system or one like it be generally available to institutions and individuals?

"It depends entirely on how much money the Veterans' Administration is willing to put into it," says Englehardt. "We have spent $72,000 on the system. Interestingly, some of the parts for the system can be purchased now for less than they cost us originally.

"The technology is here. We estimate that in five to ten years a system of this sort could be sold for the price of a medium-sized automobile—again, depending on the level of funding." AC

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Accommodates Any Type Transaction	NO	YES
Transaction Retrieval	One at a time	Screen at a time
Backdate Transactions	NO	YES
Ability to Interrupt While Printing	SOMETIMES	ALWAYS
132 COL PRINTER REQUIRED	YES	NO
NUMERIC FORMATTING	292661	292,661.42
Optional VisiCalc Interface	NO	YES
PERFORMANCE*		
Startup to Transaction Entry	113 sec	44 sec
Begin Printing Balance Sheet After Entering Transactions	162 sec	1 sec
Begin Printing Transactions After Entering Transactions	106 sec	2 sec
RATING		
Peelings II evaluation	B/D	A
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NTT Announces Creation of Advanced Chip

Nippon Telegraph & Telephone Corporation (NTT)—Japan's AT&T—opened its fourth major laboratory less than two months ago. A week after the lab opened, NTT coincidentally announced that it had succeeded in making a 1,000-bit memory chip on which 10,000 Josephson Junctions are integrated.

The race between U.S. and Japanese computer firms to build a fifth-generation computer is in full swing, and NTT's announcement came as a mild surprise. No other company had announced the integration of Josephson Junctions onto memory chips at that time.

Essentially, a Josephson Junction is a bridge between two superconductors that allows current to pass from one superconductor to the other even when there is no voltage difference between the two.

Superconductors are certain metals that have virtually no electrical resistance when kept at an extremely cold temperature (never higher than minus 422 degrees) and can sustain an electric current indefinitely. At room temperature, current flows only when there is a voltage difference, just as water flows through a garden hose connecting two pools only if one pool is higher than the other.

Josephson Junctions use a magnetic field to control the flow of current across the bridge connecting the superconductors. The current can be switched on or off in one hundred billionths of a second. A computer made with Josephson Junctions could conceivably be twenty times faster than one made with today's best semiconductor technology.

Josephson Junctions also require considerably less power and generate much less heat than semiconductors. Because of the latter attribute, computer components could be packed closer together without risking damage to the machine's reliability. A machine based on Josephson Junctions with the same power as an IBM mainframe might fit into a cube measuring six inches on a side.

NTT's new $99.1-million laboratory, located in the Tokyo suburb of Atsugi, was built to accelerate NTT's research into VLSIs—especially those employing Josephson Junctions and gallium arsenide. Using two IBM 3081-K mainframes and a Fujitsu mainframe, the lab is testimony to

GOTO page 173, column 2

ACME COMPUTERS

Computer Profile Puts a Halt To Fictitious-Employer Scam

Criminals, by nature, are an inventive breed. And, in order to combat all the various forms of criminal activity, law enforcers must also be inventive.

A few years ago in California, a certain kind of white-collar crime went virtually undetected until the damage had been done and, in some cases, the criminal had fled the coop. The crime involves setting up a phony business, hiring fictitious employees, paying unemployment-insurance taxes for the nonexistent employees, laying off the fictitious employees, and then collecting the bogus employees' jobless-benefit payments.

Known as the "fictitious-employer scheme," this kind of white-collar scam can be very lucrative—one New York man created twenty-eight phony corporations with 168 fictitious employees and hauled in $600,000 before he was apprehended.

Nowadays, with the help of a fictitious-employer profile and a special computer program, investigators at California's Employment Development Department are not only detecting every case of the fictitious-employer scheme but are detecting such schemes faster, before the phony employer has stolen more than a few thousand dollars.

Former LAPD detective Robert Keel, now chief investigator for California's EDD, developed the fictitious-employer profile in 1978. When Keel started at the EDD in 1976, he says there was only a "hand tally" system for keeping track of employers and the payment of unemployment-insurance benefits, and no one knew how much the state was being ripped off.

The fictitious-employer profile and its attendant computer program were developed through funds provided by the Department of Labor, which requires that states have some form of detection for this kind of fraud. Basically, the system compares wage data submitted by employers and unemployment-insurance claims data with a profile constructed from data of all the different ways people have perpetrated this kind of white-collar fraud.

Keel and his staff use terminals to tap into the state's Health and Welfare Data Center, which has all the current employer and employee data. They examine the employer entities that apply for unemployment-insurance benefits and determine if the companies are valid, even to the point of occasional field checking. "We'll check out the company's address," says Keel, "and make sure it isn't a vacant lot."

California's EDD has had such success with the system that about thirty other states are setting up similar programs. "We've proven that we've saved a lot of money," says Keel. "There are not a horrendous amount of fictitious-employer frauds, four or five cases a year, but each one has the potential for costing the state a hell of a lot of money."

An ironic twist to the whole story, says Keel, is what happens now after a fraud case is detected and the criminal is apprehended. Detecting a phony business is one thing, but the state will not prosecute until the fictitious employer has actually collected the phony-employee benefits.

"In the old days," says Keel, "when these kinds of criminals were making off with amounts like $80,000, the state prosecutor would jump all over the case. Now, when we catch them after only a few thousand dollars has been stolen, the cases are low on the prosecutor's list of priorities."

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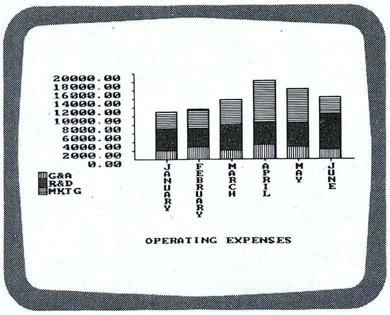

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Computer/Law

continued from page 166

search and articles on computer law.

"When we started, six years ago, a lot of the material being published about the subject was dead wrong, even shoddy," says Scott.

The main publication of the center is the *Computer/Law Journal*, a quarterly that addresses subjects like contracting, software protection, and international law. The center also does consulting for corporations and government entities, producing papers on particular legal aspects of the computer industry, as well as publishing a series of monographs and books, such as the *Computer/Law Bibliography*. The Center for Computer/Law draws upon the expertise of a network of lawyers, law professors, and other individuals for its consulting and publishing activities.

Scott says that the *Computer/Law Journal* is meant to give the center's members a "snapshot of what's going on out there. Rather than just reacting to problems as they come up, companies are trying to forestall the problems, basing their actions on legal precedents."

Members of the center can use what Scott says is "the largest collection of published materials on computer law outside of the Library of Congress." In the last three years, the center has collected close to twelve thousand volumes of books and publications from all over the world. One of its all-volunteer staff members spends a third of his time tracking down material for the library.

The center is currently working on several special projects. The first is an information sourcebook, which will be a watershed of information for those working in the areas of computer and communication law. It will include a bibliography of periodicals, a listing of organizations, a listing of all relevant state and federal agencies, legislative committees, and other government organizations, and a biographical listing of important persons in these fields from around the world.

The center is also working on a legislative compendium—a compilation of all state and federal laws and regulations in the areas of computers, communications, and information regulation—as well as an on-line database of all books, monographs, and articles written in the areas of computer and communication law.

Individuals or institutions can become members of the center for a reasonable fee that includes a year's worth of the *Computer/Law Journal* and a 20 percent discount on all books and monographs published by the center.

Sharing the same building with the Center for Computer/Law is the Law & Technology Press, a commercial company that Scott also founded. Currently, the press publishes two monthly journals/newsletters, *The Scott Report* and *Software Protection.*

Both *The Scott Report* and *Software Protection* are more timely than the *Computer/Law Journal.* Both journals offer in-depth analysis of new cases and can be very up to date, reporting on cases only weeks old.

Scott sees interesting developments in the future regarding contracting and piracy, but these are minutia compared to some of the potential legal developments as computers become a major force in our lives. He sees a possible clash forming between those who have knowledge and access to computers and those who do not.

"There could be a class distinction between those who are computer-literate and those who are computer-illiterate, with the latter demanding equal access to the technology. For instance, suppose an American bank does an economic analysis of a South American country and then refuses to let the country see the results? The country is going to demand equal access to information on themselves."

Scott sees the inequality arising from those who have the power of the computer denying it to those who do not becoming a civil rights issue. "Those who do not have the technology will realize they are at a disadvantage and will start demanding their computer rights."

The growing trend toward personal computers could be the "battleground" where some of these concerns are resolved, according to Scott.

One scenario would have the computer industry coming under government regulation so that those who can afford the technology would subsidize those who can't.

"In the long run, the computer industry could be made into a public utility. Take the phone company. There might be a backlash once people realize what deregulation means. They may want the government to step in again.

"The concept of computers as a utility is not new. An interesting book was written on the subject in the early seventies. It's an argument that's coming back into vogue, to regulate the industry for the best public interest.

"Maybe we're smarter than that now." DH

Washington State Firm Aims To Improve Documentation Writing

For years now, it's been fashionable to complain about the poor quality of user manuals, in-house training materials, and other technical documentation. This past January, Science Information Associates, a three-year-old firm based in Federal Way, Washington, began to address the issue with a more constructive attitude. The six-person company initiated publication of *Documentation Etc.*, a bimonthly newsletter directed toward high-tech professionals with an interest in improving the quality and efficacy of their written communications.

The Science Information Associates staff includes technical writers, a team consultant, a copywriter, an art director, and a graphics artist. In addition to publishing *Documentation Etc.*, the group conducts seminars and does consulting, writing, editing, and production work for high-technology firms.

Before forming Science Information Associates in July 1980, company founder Nichole Vick worked as a technical writer, public information specialist, and publications manager for various scientific publications. Fascinated by technology, Vick is convinced that it is possible—and essential—for people to communicate clearly about hardware, software, and other computer-related matters. The firms' vice president is Vick's husband, Ray Styles, whose previous experience involves the programming and design of computer applications software and operating systems.

In the course of their professional lives, both Vick and Styles have read volumes upon volumes of technical material, the majority of it disappointing. At first, says Vick, the idea of doing documentation writing was exciting to her, but after reading much of it she had the impression that "people must not really want it to be good; their work violated all the principles of good technical writing."

After thinking things over, she came to the conclusion that the poor quality of the materials they'd read had more to do with the fact that the people involved really didn't know how to create good documentation. She also realized that most organizations give documentation very low priority. Budget constraints, tight schedules, and historical precedent all contribute to the notion that documentation is less than essential, "frosting on the cake." As Ray Styles puts it, "When you're fighting fires, you want to get the program running; you'll worry about explaining it later."

Vick and Styles see this attitude as shortsighted. Companies that don't create useful, easily understood documentation for their in-house systems and their end-user products cost themselves time and money down the road because they are constantly getting questions from users who can't find the answer in the manual. In addition, companies forfeit the advantages that clear, organized thinking and communicating would give them in their daily work.

Documentation Etc. is one significant way Science Information Associates is attempting to change people's attitudes about the importance of good documentation. Each issue of the newsletter focuses on a specific documentation or marketing-related concern. The January/February topic was user manual design, and readers received a useful, thoughtfully illustrated introduction to the principles of graphic design. March/April's installment explored the idea of using documentation as a project management tool. In May/June, the subject was user manuals once again, but this time the emphasis was on content—what makes a good manual and how do you go about creating one? The July/August edition focused on the development of internal documentation standards. Each issue features a q-and-a section.

Communicating about communicating isn't easy. The people at Science Information just make it look that way. JV

NTT

continued from page 170

NTT's commitment to keep up with, if not outpace, American research. Prior to 1981, when a U.S.-Japan government procurement agreement went into effect, NTT had never used a large foreign-made computer in its research.

On this side of the Pacific, American firms are not worried much by NTT's announcement of the Josephson Junction integrated chip. It's well known around the industry that IBM is probably the world leader in Josephson Junction research; it's also well known that IBM doesn't talk much about its ongoing research. Even NTT concedes that IBM has more accumulated knowledge of the advanced technology, though no one outside of Big Blue knows how far that company has progressed. DH

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Chip Industry

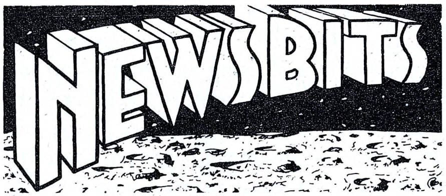
continued from page 166

chip, turned orders around in about fifteen working days. Now the company is warning buyers to expect to wait nine to fourteen weeks for delivery of chips.

Many chip makers are warning their customers to plan ahead, particularly since the practice of allocating chips among buyers may become necessary. All indications point to this happening in the near future. National Semiconductor has already begun allocating certain chips to distributors and may soon begin rationing those products it sells directly to manufacturers.

Chip distributors who hold supplies of particular products are benefiting from the shortage, and some profiteering distributors are raising the prices of chips as high as the market will bear.

As semiconductor companies return to full operation, most industry experts are predicting the current shortage of chips to continue into next year. DH



Δ **European Robots.** The Palexpo Exhibition Center in Geneva, Switzerland, will be the site of AUTOFACT Europe, to be held September 13–15. The conference session for Wednesday, September 14, will be devoted to robotics.

Δ **Attention, Controllers.** The Ninth Annual Advanced Control Conference will be held September 19–21 at Purdue University in West Lafayette, Indiana. This year's conference is entitled "Learning Systems and Pattern Recognition in Industrial Control." Conference subjects include speech recognition, intelligent vision systems, robotics, and artificial intelligence.

Δ **Heroic Accessories.** Perbotics (Huntington Beach, California) has announced several accessories for Heath's Hero-I robot. A 44K programmable memory board expands Hero-I's on-board memory to 48K and includes an RS-232C port. Also available are an 8K memory board and a cassette tape providing load and dump routines that work through the RS-232C port.

Δ **Computers and Psychology.** Joseph D. Matarazzo, in an editorial published in the July 22 issue of *Science*, addressed the growing use of computers for psychological testing, warning that there is "a danger that wholesale use of automated tests by people without a knowledge of their limitations will be a disservice to the public." Matarazzo stresses that the results of computerized psychological tests still must be scientifically appraised. Even when carried out by experts, the interpretation of such tests is not an objective activity. He concludes, rather gloomily, "My experience as an expert witness leaves me in no doubt that a flood of litigation involving unqualified users of the products of this new technology is just around the corner."

Δ **Coin-Hungry Apples.** High-Tech Entertainment (Muncie, Indiana) has created a coin-operated network called Micro Coin for entertainment, educational, and business uses. Several Apples are tied together via a custom network that allows users to access hundreds of programs stored on a hard disk. Users come into a Micro Coin facility and buy time through a standard coin slot. Different applications run at different rates, and the company offers discount rates for different times of the day or days of the week. High-Tech Entertainment is currently redesigning some aspects of the system and plans to begin marketing the system to amusement operators by the end of this year. Within eighteen months, the firm will make the system available to schools, public libraries, and software merchandisers, according to High-Tech Entertainment's president Samuel M. Roberts.

Δ **To Service Computers.** Computer manufacturers frequently spend a lot of money sending overqualified personnel on service assignments when the problem with a customer's machine may be only that it needs a simple part replaced. Air Couriers International, a Phoenix-based air courier service, has inaugurated a nontechnical field support service designed to save both computer manufacturers and customers time and money. When a computer breaks down and the manufacturer can diagnose the problem by phone, Air Courier picks up the needed part and sends it on the next available plane to the customer. When the part arrives at its destination, another Air Courier employee delivers the part to the customer, along with an enclosed diagram showing how to remove the defective part and replace it with a new one. The old part is then shipped back to the manufacturer. ▲

Editor **David Hunter**
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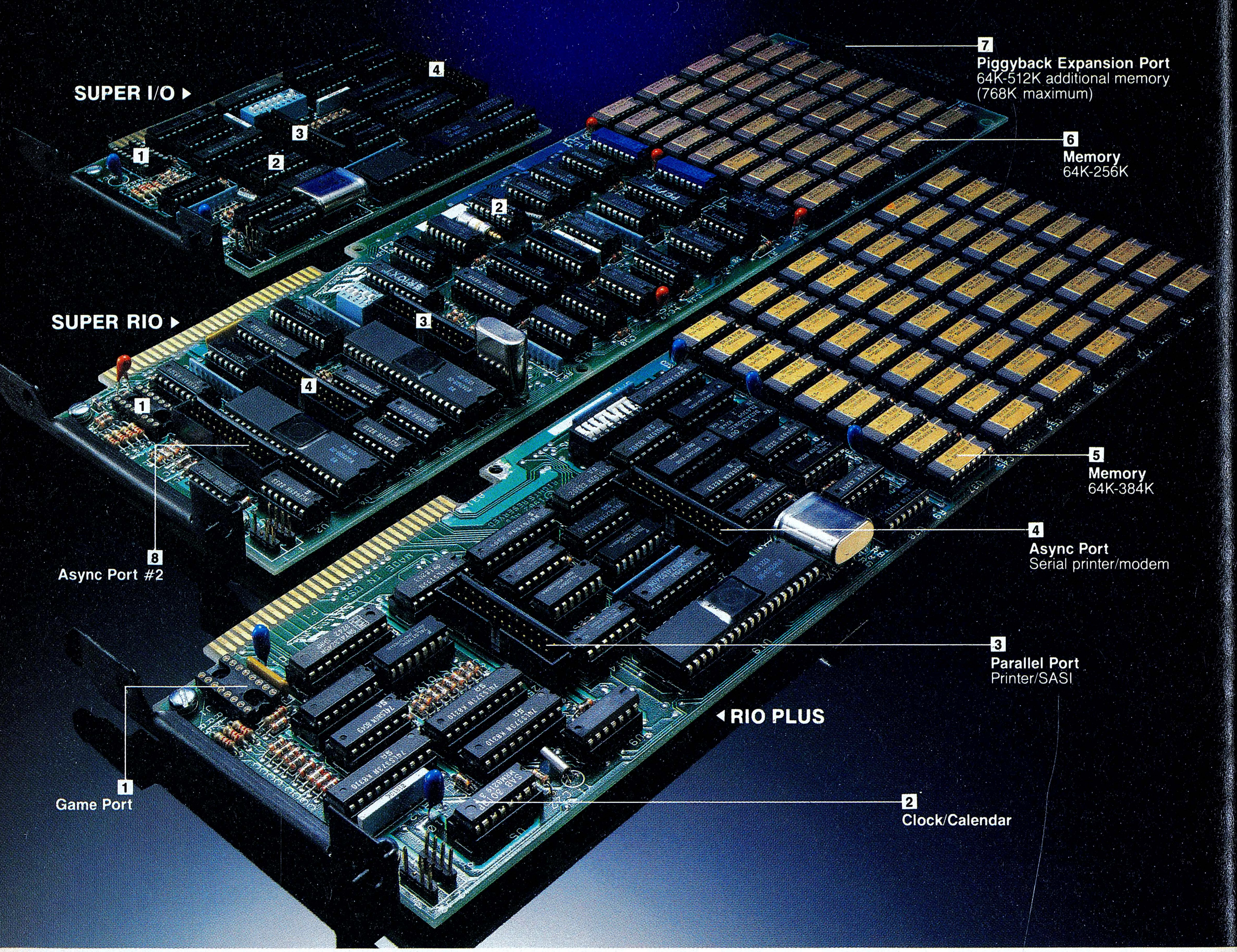

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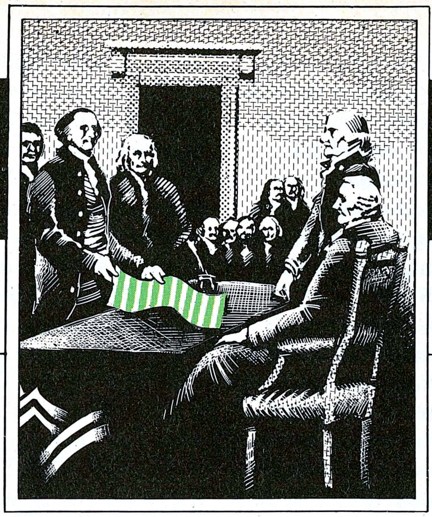

THE RIGHT TO ASSEMBLE

by Ray Duncan

The Data Movement Instruction Group

This month we will briefly discuss one instruction group of the Intel 8088 microprocessor. We'll also present another source listing to help familiarize you with the process of editing, assembling, and running an assembly language program.

The instruction set of the Intel 8088 is sophisticated and complex, and includes some seventy basic instructions, many of which can use up to thirty different addressing modes. Luckily, the available operations fall into a much smaller number of distinct classes according to their function, making them considerably easier to master. Also, a significant portion of the instruction set is designed for very specialized or systems-level operations and can be safely ignored by the beginner.

You will find a comprehensive reference book on the 8088 to be an invaluable aid as you embark on your assembly language programming efforts. It should be kept right next to the computer, because even after you gain considerable experience you will frequently need to look up information on uncommonly used operations, status flags, and addressing modes. Recommended books include *The 8086 Book* by Rector and Alexy, *IBM PC Assembly Language Programming* by Scanlon, and *The iAPX 86,88 Users Manual* by Intel. They are available at most retail computer stores; each has a slightly different orientation, and you may eventually wish to purchase all three. You will also need copies of the IBM DOS manual and *Technical Reference* manual close at hand.

Data Movement Instruction Group. This month we'll look at four instructions: MOV, PUSH, POP, and REP MOVS.

The MOV instruction transfers data between registers or between registers and memory. Many, many addressing mode combinations are available for this instruction, but one thing you can't do is use MOV to transfer data directly from one memory location to another.

The instruction format is:

```
MOV destination,source
```

The destination may be any legal register or effective memory address; the source can be a register, effective address, or an "immediate" data value. After a MOV operation, the contents of the source are unchanged and the previous contents of the destination are lost.

Examples of legal MOV instructions:

```
MOV AX,BX      ;copy contents of
               ;register BX
               ;into register AX
MOV AX,1       ;move the value 1 into
               ;register AX
MOV AX,label   ;move the contents of
               ;location "label"
               ;into register AX
MOV AX,[BX]    ;move the contents of
               ;the memory
               ;location whose address
               ;is in BX
               ;into register AX
```

Of course, the source and destination must have the same data size (eight or sixteen bits); it would be nonsense to try to move the contents of BH (an eight-bit register) into AX (a sixteen-bit register), and the assembler will flag such an instruction as an error. When you move data to or from a labeled memory location, the assembler may flag other operations as errors regardless of your intent; for example, loading an eight-bit register with the contents of the first byte of a named variable that has the "word" attribute will generate an error warning—even if you do it on purpose.

When you're transferring data by means of indexed addressing (as the [BX] example above does), pay attention to the contents of your segment registers! Indexed addressing via [BX], [SI], or [DI] forms the memory address with DS (data segment register), while indexing through [BP] forms the memory address with SS (stack segment register). Similarly, the combinations [BX+DI] or [BX+SI] use DS, while [BP+DI] or [BP+SI] employ SS for calculation of the memory address. These are only defaults, and in almost every case you can modify them with the SEG instruction, which we will cover later. A case where you can't override the default segment register is the use of DI for the destination address in "string" processing instructions; here the address is always calculated in combination with ES (Extra Segment Register).

There are also some subtle restrictions on use of the MOV instruction. You cannot move data directly from one segment register to another (it must be moved from a seg-

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ment register to a general register and then to the destination segment register), and you cannot move immediate data into a segment register. A very complete set of examples of the different possible addressing modes used with the MOV instruction may be found on pages 6-12 through 6-16 of the IBM *Macro Assembler* manual.

The PUSH instruction transfers a sixteen-bit item onto the data stack. The memory address of the current "top of stack" is formed by the combination of SP (Stack Pointer) and SS (Stack Segment Register). The stack grows downward in memory, so when you PUSH something, SP is first decremented by 2 and then the data is copied to the memory location whose address is SS:SP. An interesting and powerful feature of the PUSH instruction on the 8088 is that its operand can be either a register or an effective memory address; most programmers fail to exploit this capability since the older eight-bit microcomputers allowed you to PUSH only the contents of registers.

Examples of PUSH:

```
PUSH AX    ;push contents of register
           ;AX
PUSH DS    ;push contents of segment
           ;register DS
PUSH label ;push contents of the
           ;memory
           ;location whose address is
           ;signified by "label"
PUSH [BX]  ;push contents of the
           ;memory location
           ;whose address is
           ;in the register BX (indexed
           ;addressing) combined
           ;with DS
           ;segment register
```

There are only a couple of restrictions on the PUSH instruction: You can't push an eight-bit register, and you can't push an immediate data value.

There is a special instruction PUSHF to put the CPU's status flags on the stack. This is rarely used by the application programmer.

The POP instruction transfers a sixteen-bit item from the data stack to a register or a memory location. It takes the same types of operands as the PUSH instruction. The contents of the memory address formed by SS:SP are copied into the specified destination, then SP is incremented by 2. One restriction on POP in addition to those that apply to PUSH is that you can't pop anything into the CS register (you *are* allowed to PUSH CS), because this would have the effect of executing a JMP.

This is a special POPF operation that restores the CPU status flags from data that was previously placed on the stack by a PUSHF instruction.

Finally, the REP MOVS instruction combination allows you to transfer a "string" of items in a single operation. It can operate on either bytes or words. The address of the source is assumed to be in register SI, while the address of the destination is in DI. SI defaults to the Data Segment but can be overridden, while DI always forms its address in combination with the Extra Segment Register and cannot be overridden. The CX register contains the count of items to be moved.

As each item is moved, CX is decremented by 1 and the SI and DI registers are either incremented or decremented, depending on the status of the Direction Flag (which was previously set or cleared, with STD or CLD respectively). When CX reaches 0, the operation terminates. If you do not prefix MOVS with REP, only one item will be moved, CX will be decremented by 1, and SI and DI will be incremented or decremented by 1 or 2 (1 if by byte, 2 if by word). MOVS is hardly ever used without REP, although some of the 8088's other string instructions (for scanning and translating) are frequently used alone.

When you write the MOVS instruction in your program, you must supply something in the operand field to tell the assembler whether you are requesting a byte operation or a word operation. Alternatively, you can use the auxiliary instruction mnemonics MOVSB (move byte string) or MOVSW (move word string) to avoid this requirement. Legal string move instructions:

```
REP MOVS AL,AL           ;byte move
REP MOVS WORD PTR
ES:[DI],DS:[SI]          ;word move
REP MOVSB                ;byte move
REP MOVSW                ;word move
```

Although the assembler may use the contents of the operand field to determine the data-item size, the addresses and string length are *always* taken from the registers SI, DI, and CX, which must have been previously set up by the program. As an example, consider moving a ten-byte string from the location named "GREEN" to the location named "BLUE," both of which are in the current data segment (see below).

Note that when we initialized DI and SI, we used the "offset" modifier to load the *addresses* of the variables GREEN and BLUE. Otherwise we would have gotten something entirely different and in this case very undesirable. The instruction:

```
MOV SI,GREEN
```

would load the *contents* of the location GREEN into register SI, rather than the *address* of location GREEN. This is a distinction that is crucial in 8088 assembly language programs yet often proves baffling at first to the ex-Basic programmer who has never before had to worry about the addresses of data objects.

VMODE Utility Program. This month's little assembly language utility, called VMODE (in the accompanying listing), allows

```
MOV AX,DS                ;make ES point to the
MOV ES,AX                ;same segment as DS
MOV SI,offset GREEN      ;source is GREEN
MOV DI,offset BLUE       ;destination is BLUE
MOV CX,10                ;number of items to be
                         ;moved is ten
CLD                      ;make sure the Direction
                         ;Flag is cleared
REP MOVSB                ;now transfer byte string
```

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you to set the pc's video display mode directly. This will be most useful to people who have two monitors on their systems. VMODE is invoked from PC-DOS with the desired mode number on the command line:

```
A>VMODE 7
```

The mode number must be from 0 through 7. These values correspond to the following display types:

	color/graphics adapter text modes
0	**40 x 25 black and white text**
1	**40 x 25 color text**
2	**80 x 25 black and white text**
3	**80 x 25 color text**
	color/graphics adapter graphics modes
4	**320 x 200 color**
5	**320 x 200 black and white**
6	**640 x 200 black and white**
7	**monochrome monitor**

For RGB monitors, there is no functional difference between the black-and-white and color text modes. Modes 4 and 5 both actually display color graphics; however, the color palettes as defined by IBM are operative only in mode 4. Mode 5 gives a slightly different set of colors and can be used as a third palette.

Aside from whatever practical use it may have, VMODE illustrates a number of operations and techniques that will be essential to assembly language programming under PC-DOS. *Software interrupts* (INT instructions) are used several times to invoke different services provided by the IBM resident software.

The INT 10H instruction performs a direct call on function 0 of the video driver in the ROM BIOS to set the display mode. See pages A-43 and A-44 of the *Technical Reference* manual for a complete description of the available video services and their calling parameters.

The INT 21H instruction is a PC-DOS system service call. The function number (9 for *output text string*) is passed in register AH, and the relevant parameter (the address of the string to be output) is, in this case, passed in register DX. A complete list of the available PC-DOS services is found in Appendix D of the DOS manual. There are many different functions available and you will not want to try to understand them all at once. For the present, just read the introductory material in that appendix and the description of function 9.

Finally, when the program is finished it returns control to PC-DOS by performing an INT 20H. This is the "approved" way to terminate execution of a program. You can get the same effect, however, by an INT 21H instruction with register AH equal to 0.

Note the use of the SCAS (*scan string*) instruction to find the first nonblank character in the command tail. This is one of the more sophisticated 8088 instructions, one that can be used to detect either the first or last occurrence of a desired character, depending on whether REPZ or REPNZ is used as a prefix. When the SCAS operation finishes, DI has already been incremented past the significant character, so we must use an offset of −1 on the DI indexed load to fetch the character into AL.

To make these short introductory programs easier to understand, we are keeping all of the code, data, and stack in the same segment and creating a COM file for execution. When a program is written in this way, the linker will give you an error message ("missing STACK segment"), which you can ignore. See listing 2 for the steps to go through to assemble, link, and convert VMODE into a COM file.

Here are a few important facts about the COM program type: When the program receives control from PC-DOS, all four segment registers are set to the same value (the address of the Program Segment Prefix).

The Instruction Pointer is set to 100H.

The default File Control Blocks are at offsets 05CH and 06CH (just as in CP/M). If anything useful is in the second FCB at 06CH, it must be moved somewhere else for safekeeping or it will be destroyed when the file designated by the first FCB is opened.

The "command tail," which contains all text on the original command line after the program name, is placed at offset 081H, with its length in the byte at 080H. VMODE uses this feature to pick up the mode number.

The SP register is set to the end of the program's segment or the bottom of the transient portion of Command.com, whichever is lower. A word of 0s is pushed onto the stack by PC-DOS before it enters your program.

The word at offset 6 gives the size of the program's segment minus 256 bytes for the data stack.

The default disk transfer address (DTA) is set to 080H, causing a potential collision with your command tail information. Also, since only 128 bytes of buffer are available at that address, you must change the DTA if you plan to read or write disk records of a larger size.

Next month, we'll discuss the arithmetic/logical instruction group and present another assembly language utility that will illustrate the use of different code, data, and stack segments.

→

the 1dir

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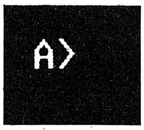

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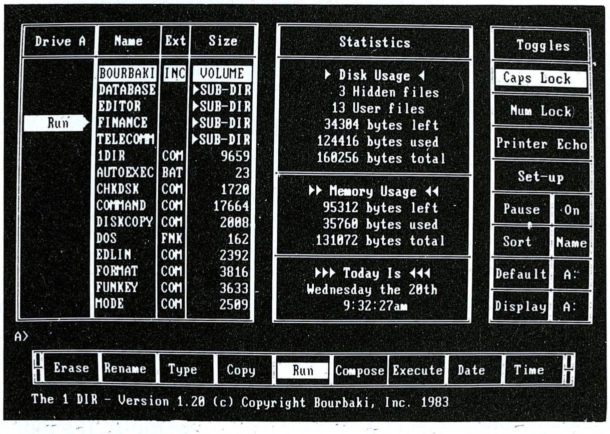

```
Name      Ext  Size        Statistics
BOURBAKI  INC  VOLUME      ▸ Disk Usage ◂
DATABASE       ▸SUB-DIR     3 Hidden files
EDITOR         ▸SUB-DIR     13 User files
FINANCE        ▸SUB-DIR     34304 bytes left
TELECOMM       ▸SUB-DIR     124416 bytes used
1DIR      COM     9659      160256 bytes total
AUTOEXEC  BAT       23
CHKDSK    COM     1720     ▸▸ Memory Usage ◂◂
COMMAND   COM    17664      95312 bytes left
DISKCOPY  COM     2008      35760 bytes used
DOS       FNK      162      131072 bytes total
EDLIN     COM     2392
FORMAT    COM     3816     ▸▸▸ Today Is ◂◂◂
FUNKEY    COM     3633     Wednesday the 20th
MODE      COM     2509      9:32:27am
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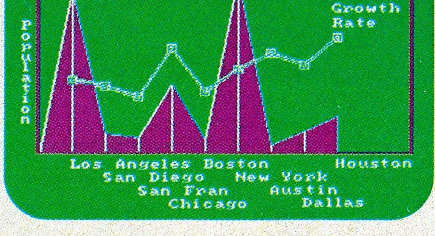

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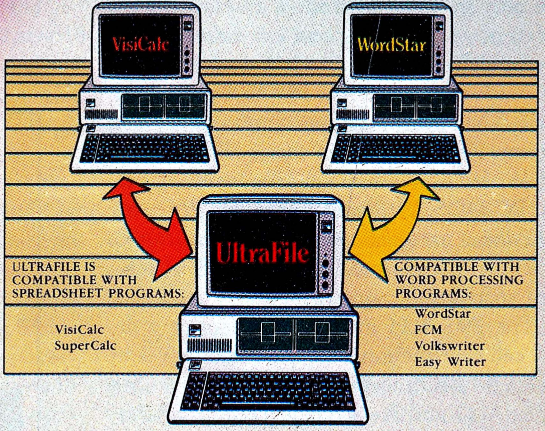
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```
The IBM Personal Computer Assembler 07-30-83          PAGE   1-2
'VMODE --- Set PC Video Mode'

                                   name     vmode
                                   page     55,132
                                   title    'VMODE --- Set PC Video Mode'
                          ;
                          ; VMODE utility to set display
                          ; mode on IBM Personal Computer
                          ;
                          ; Ray Duncan, July 1983
                          ;
 = 0080                   input    equ      080h        ;address of command tail
                                                        ;buffer (set up by DOS)
 = 0020                   blank    equ      20h         ;ASCII blank code
 = 000D                   cr       equ      0dh         ;ASCII carriage return
 = 000A                   lf       equ      0ah         ;ASCII line feed
                          ;
                          ;
 0000                     cseg     segment  byte
                                   assume   cs:cseg,ds:cseg
 0100                              org      100h
                          ;
 0100                     vmode:                        ;initialize DI to the
                                                        ;address of the input buffer
 0100   BF 0080                    mov      di,offset input
 0103   8A 05                      mov      al,[di]     ;check if any command tail
 0105   0A C0                      or       al,al       ;and exit if not
 0107   74 40                      jz       vmode7
 0109   B0 20                      mov      al,blank    ;load ASCII blank for scan
 010B   47                         inc      di          ;increment address in DI
                                                        ;past the input count byte
 010C   B9 0050                    mov      cx,80       ;scan max of 80 chars.
 010F   FC                         cld                  ;clear direction flag
 0110   F3/ AE                     repz scasb           ;look for first none-blank
                                                        ;character in input buffer
 0112   74 35                      jz       vmode7      ;jump if none found
                                                        ;load the none-blank char.,
                                                        ;use offset of -1 since DI
                                                        ;will be pointing past it
 0114   8A 45 FF                   mov      al,-1 [di]
 0117   3C 0D                      cmp      al,cr       ;if first none-blank char
                                                        ;was RETURN,mode was missing
 0119   74 2E                      jz       vmode7      ;so go print error message
 011B   3C 30                      cmp      al,'0'      ;make sure it is range 0-7
 011D   72 2F                      jb       vmode8      ;exit if ASCII code < '0'
 011F   3C 37                      cmp      al,'7'
 0121   77 2B                      ja       vmode8      ;exit if ASCII code >'7'
 0123   A2 016B   R                mov      vmodeb,al   ;store mode number into
                                                        ;output string
 0126   24 0F                      and      al,0fh      ;mask off upper four bits
                                                        ;of char. to get 0-7
 0128   50                         push     ax          ;save mode for later
 0129   33 DB                      xor      bx,bx       ;set ES=zero
 012B   8E C3                      mov      es,bx
 012D   BB 0410                    mov      bx,410h     ;set BX=addr of DOS's
                                                        ;equipment flags word
 0130   3C 07                      cmp      al,7        ;check if monochrome
                                                        ;or graphics board
 0132   B0 30                      mov      al,30h      ;assume monochrome
 0134   74 02                      jz       vmode6
 0136   B0 20                      mov      al,20h      ;no,was graphics board
 0138                     vmode6:                       ;mask off the old
                                                        ;display equipment flags
 0138   26: 80 27 CF               and      byte ptr es:[bx],0cfh
                                                        ;merge in the proper flag
                                                        ;for newly selected display
 013C   26: 08 07                  or       es:[bx],al
 013F   58                         pop      ax          ;recover mode
 0140   32 E4                      xor      ah,ah       ;force AH=zero
 0142   CD 10                      int      10h         ;and call ROM BIOS
                                                        ;to set new display,
                                                        ;go print success
                                                        ;message and exit
 0144   BA 0157   R                mov      dx,offset vmodea
 0147   EB 08                      jmp      short vmode9
 0149                     vmode7:                       ;print "missing mode number"
 0149   BA 016F   R                mov      dx,offset vmodec
 014C   EB 03                      jmp      short vmode9
 014E                     vmode8:                       ;print "illegal mode number"
 014E   BA 0188   R                mov      dx,offset vmoded
 0151                     vmode9:                       ;print the message whose
                                                        ;address is in reg. DX
 0151   B4 09                      mov      ah,9        ;function 9 = print string
 0153   CD 21                      int      21h         ;call DOS to print
                                                        ;now exit back to DOS
 0155   CD 20                      int      20h
                          ;
 0157   0D 0A             vmodea   db       cr,lf
 0159   56 69 64 65 6F 20          db       'Video mode set to '
        6D 6F 64 65 20 73
        65 74 20 74 6F 20
 016B   20 0D 0A 24       vmodeb   db       ' ',cr,lf,'$'
 016F   0D 0A             vmodec   db       cr,lf
 0171   4D 69 73 73 69 6E          db       'Missing mode number.'
        67 20 6D 6F 64 65
        20 6E 75 6D 62 65
        72 2E
 0185   0D 0A 24                   db       cr,lf,'$'
 0188   0D 0A             vmoded   db       cr,lf
 018A   49 6C 6C 65 67 61          db       'Illegal mode number.'
        6C 20 6D 6F 64 65
        20 6E 75 6D 62 65
        72 2E
 019E   0D 0A 24                   db       cr,lf,'$'
                          ;
 01A1                     cseg     ends
                          ;
                                   end      vmode
```

Listing 1.

```
The IBM Personal Computer Assembler 07-30-83     PAGE   Symbols-1
'VMODE --- Set PC Video Mode'
Segments and groups:

        Name                    Size    Align   Combine Class

CSEG . . . . . . . . . . . .    01A1    BYTE    NONE

Symbols:

        Name                    Type    Value   Attr

BLANK  . . . . . . . . . . .    Number  0020
CR . . . . . . . . . . . . .    Number  000D
INPUT  . . . . . . . . . . .    Number  0080
LF . . . . . . . . . . . . .    Number  000A
VMODE. . . . . . . . . . . .    L NEAR  0100    CSEG
VMODE6 . . . . . . . . . . .    L NEAR  0138    CSEG
VMODE7 . . . . . . . . . . .    L NEAR  0149    CSEG
VMODE8 . . . . . . . . . . .    L NEAR  014E    CSEG
VMODE9 . . . . . . . . . . .    L NEAR  0151    CSEG
VMODEA . . . . . . . . . . .    L BYTE  0157    CSEG
VMODEB . . . . . . . . . . .    L BYTE  016B    CSEG
VMODEC . . . . . . . . . . .    L BYTE  016F    CSEG
VMODED . . . . . . . . . . .    L BYTE  0188    CSEG

Warning Severe
Errors  Errors
0       0
```

Listing 2. ▲

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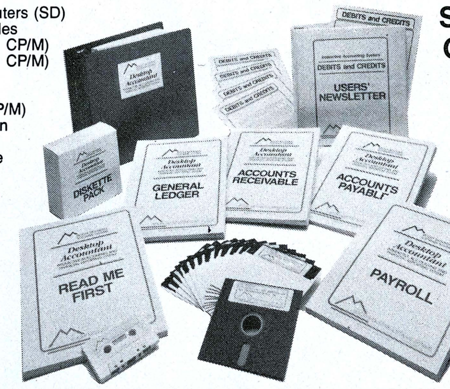

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beginners' corner

by Craig Stinson

Loose Endings: Shifts, Toggles, and Interrupts

This month's installment is the last of the present "Beginners' Corner" series. If you have followed along this far, you're no longer a beginner. It's possible that in the future, should public outcry make it advisable, another author will begin anew, all over again from the top. Your feedback in this matter is welcome.

Meanwhile, we have a few loose ends to tie up regarding keyboard input. And we promised a word or two about interrupts on the pc.

You may recall that the normal course of events occurring in response to a tap on the pc keyboard is something like this: You press a key. A microprocessor located inside your keyboard generates an electrical signal appropriate to the key you pressed and sends that signal down the cable to the 8088 inside your pc. The signal is called a scan code.

Receipt of the scan code inside your pc generates an *interrupt*. The interrupt, under ordinary circumstances (that is, except in the rare case where the 8088 has been instructed to ignore interrupts temporarily), causes the 8088 to set aside whatever program it happens to be running. The processor does that more or less literally: It finishes the instruction it's currently executing, then it clears its registers of all the vital information it will need when it's ready to resume running its current program, and stores that information in a specific area of memory. Then it attends to the interrupt.

Many forms of interrupt are possible on the pc; each is identified by a specific number. The keyboard generates an interrupt identified as number 9. Located at the very bottom end of memory, in addresses 0 through 1024 (decimal), is a table of numbers (called a *vector* table) whose function is to tell the microprocessor what to do in the event of an interrupt. Each of the different interrupt types sends the 8088 to a specific four bytes within this table. Interrupt 9 sends it to the four bytes located from address 36 to address 39.

Those four bytes together constitute another address. Like a kid on a scavenger hunt, the 8088 gets this second address from the relevant slot in the vector table and marches thither for further orders. Finally, at the address pointed to by the vector table, the processor gets instructions that constitute the *service routine* appropriate to the given interrupt type.

Interrupt 9 sends the 8088 to a section of the ROM BIOS called KEYBOARD_IO. This chunk of permanently resident system programming deciphers the keyboard scan code information and sends it to certain registers within the 8088; then it generates a return-from-interrupt instruction, which means it tells the microprocessor to reload its application program status information and go on about its business (we're using the term application program here to distinguish the program running on the 8088 *before* the interrupt occurs from the service routine that runs *in response to* the interrupt; that first program could be a true application, like *VisiCalc*, or it could be something much more fundamental, like DOS).

If KEYBOARD_IO detects an ASCII character (such as p or &), it sends the ASCII value to one register and the scan code to another. If it detects one of the pc's special characters, like one of the function or alt keys, then it sends a 0 to the register that would otherwise get an ASCII value and the scan code to the other register. If KEYBOARD_IO detects any of four particular keystroke combinations (control-alt-delete, control-num lock, control-break, or shift-printscreen) it generates a second interrupt (interrupt service routines may themselves be interrupted), whereupon something else occurs—a system reset for example, or a dump of screen contents to the printer. If it detects keystroke combinations that it deems meaningless (like control-escape or alt-num lock), it merely returns control to the application program.

So far so good. In fact we got almost this far last month. What we didn't get to last time are certain scan codes in response to which KEYBOARD_IO does none of the above: the scan codes generated by the pc's four shift keys and four status toggles.

For a little diversion, try the following exercise. Put your DOS disk (the one with the pink label or a copy thereof) in drive A and type the command *Basic*. Now enter the following programlet, just as you see it here:

```
10  cls
20  def seg = 0
30  locate 15
40  print using "###"; peek (&h417)
50  goto 30
```

Be sure to type everything exactly as it's

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shown here, hitting the enter key at the end of each line. If you make a typo before hitting enter, just backspace to it and fix. If you discover a typo after you've finished a line, just reenter the line (there are simpler ways to fix a program line, but they're more complicated to explain).

Okay. Now type *run* and hit enter (or just hit the F2 key; that does the same thing). The screen should clear and a lone number should appear—probably, but not necessarily, a 0.

Now hold down the shift key on the right side of the keyboard. The number on your screen should increase by one; when you let go of the shift key, the original number should appear. Do the same with the shift key on the left side of the keyboard and notice the difference in effect. Now try the control key and the alt key.

There are actually four shift keys on your keyboard. Two of them are ordinary secretarial shift keys that turn lowercase letters into capitals. The other two, control and alternate, have other effects, as you know. What all four shift keys do is cause KEYBOARD_IO to alter the contents of a specific memory location—address 417 hexadecimal (1047 in decimal notation). The little Basic program you just typed in goes around a loop, reading location 417 on each pass and reporting its contents to the screen. When you press one of the shift keys, you interrupt the Basic program, and when the Basic program resumes, it sees the change at 417 and alters the number on-screen appropriately.

Notice that the numbers produced by the four shift keys—1, 2, 4, and 8—are exact powers of two. If you've had a little experience with binary counting, you'll probably recognize what's going on here. The binary equivalents of 1, 2, 4, and 8, are respectively 00000001, 00000010, 00000100, and 00001000. Each of the four least significant bits of the byte stored at address 417 (*least significant* here means the four bits on the right as we humans notate them) is a status bit for one of the four shift keys. When a shift key is pressed, its status bit changes from 0 to 1.

Note too that the shift keys—even the two secretarial shift keys—act entirely independently of one another. If you hold down two or more of them at once, the number that appears at 417 is the sum of the individual status values.

Now on to the four toggle keys. Experiment with the scroll lock, num lock, caps lock, and insert keys and see how they affect the output of your Basic program. You should notice a couple of things.

First, the keys just named install the next four powers of two (16, 32, 64, and 128) into location 417. Which means that the four most significant bits of that byte are status symbols for these four keys.

Second, whereas the shift keys only set their respective status bits to 1s *while* you hold them down, these other four keys switch their bits back and forth each time you press them (if you happen to be using a Compaq, you'll discover that three of these four keys have repeating effects when held down, but that's because of a minor bug in Compaq's ROM BIOS and it's beside the point of this discussion). That's why scroll lock, num lock, caps lock, and insert are referred to as toggles; a toggle is a command (it may be one keystroke or many) that causes something to alternate between two states.

The primary function of the four shift keys and four toggles is to act as filters for keyboard input. That is to say, what becomes of your keyboard characters, as they pass through KEYBOARD_IO on their way to your application program, depends on

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what's stored at memory location 417.

Application programs, however, may themselves examine 417 and modify their behavior according to what they find. Lotus's *1-2-3*, for instance, normally scrolls by moving the cursor across a stationary background. But if you set the scroll lock status bit, the program scrolls in a different manner, by holding the cursor in place and moving the background. For an ingenious and very different use of the scroll lock toggle and the two secretarial shift keys by an application program, see John Socha's "The Scroll Lock Mystery Solved," in *Softalk*, May 1983.

What happens if you press one or more of the shift keys in conjunction with one or more of the toggles? That depends on what else is going on in your computer when you do it, of course, because application programs *can* use these key combinations as command signals if they wish. But if your little Basic loop is still looping, what you'll see for most of the possible shift-toggle combinations is an additive effect upon the contents of location 417.

Three of the possible combinations, of course, will not produce an additive effect (at least they won't do it visibly). Control-alt-delete will reset your system; control-num lock will suspend output of your Basic program, and control-scroll lock (control-break) will release your program from its tedious looping. When the ROM BIOS detects these combinations it issues its own interrupt instructions (causing an interruption to interrupt service routine number 9). The 8088, in reponse, jumps to the appropriate address in the interrupt vector table, jumps again to the address it finds there, and proceeds according to instructions.

Which brings us to a few parting remarks about the interrupt process.

Interrupts may be either hardware-generated or software-generated. The keyboard produces a hardware interrupt. So does the pc's internal clock, which breaks into your programs approximately eighteen times every second (that interrupt may be used by application programs to update a clock display, increment a counter for the purpose of random-number seeding, or for any number of other things; most programs, however, just ignore the clock interrupt).

To produce a *software* interrupt, the programmer merely inserts the assembly language instruction INT into his code, followed by a number that tells the 8088 which interrupt vector to go to. Hardware and software interrupts, in general, do the same thing; the difference in their effects has to do only with the service routine to which they send the microprocessor.

We won't get into a discussion of why the software interrupt was included in the 8088's instruction set (for answers to that question, see "Snooping in ROM: The Software Interrupt," by Peter Norton, *Softalk*, February 1983). For now let it suffice to say that the provision for interrupts—both software and hardware—contributes enormously to both your computer's flexibility and its responsiveness to events outside itself.

The more you learn about your computer the more you'll see how its designers worked to make it as powerful as possible while locking you into as little as possible. The balance they achieved is remarkable: Your machine is on the one hand ignorant and indifferent, and at the same time smart, fast, and obedient—the consummate electronic tabula rasa. ▲

This brings us to the end of our trip together. If you would like to see a "Beginners' Corner" begin again please address your comments to Softalk/IBM, Box 60, North Hollywood, CA 91603. If there are particular topics you'd like covered, please let us know of those as well.

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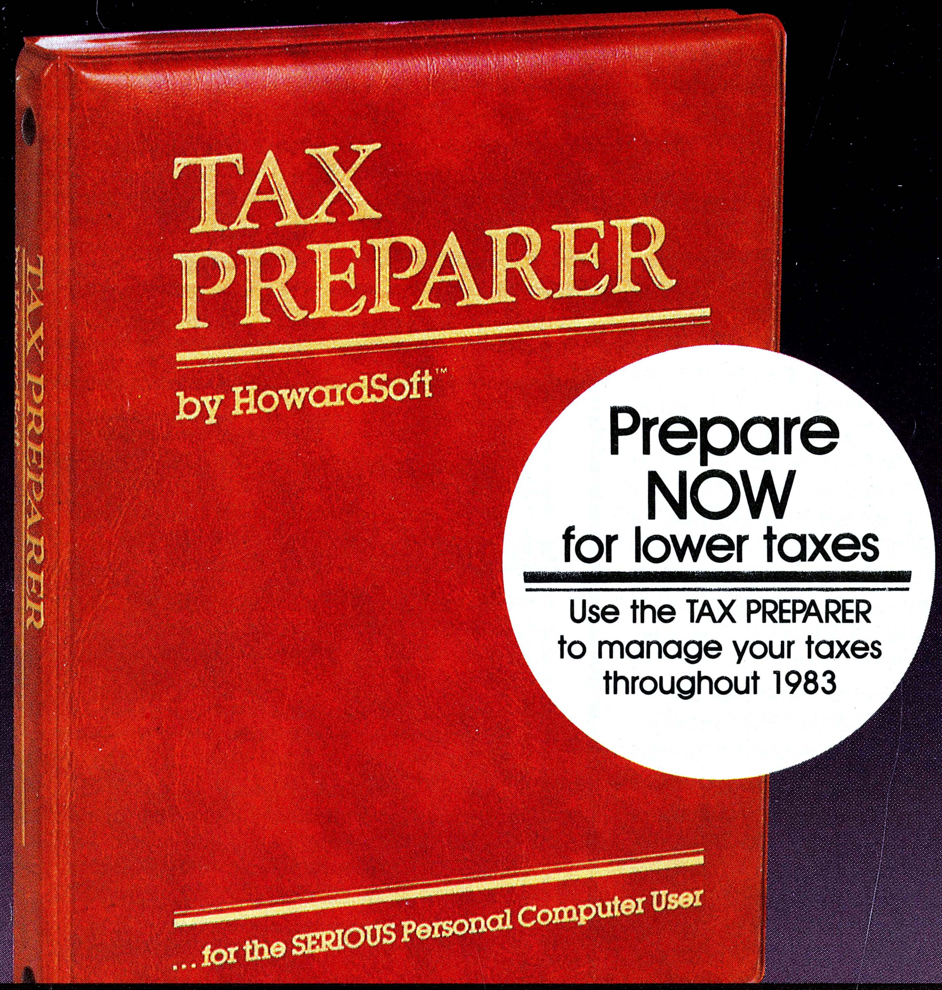
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It's not any safer to have a significant share in a software area. VisiCorp had the spreadsheet market all to itself for years. Then *SuperCalc* claimed the CP/M market and *1-2-3* came along to grab off the lead among pc owners. *Multiplan* is pressing *VisiCalc* in the Apple market and *MBA* is making inroads against *VisiCalc* in the Hewlett-Packard market.

For all of that, one product seemed relatively secure and above the fray. That was *WordStar*. It still has no truly viable competitor in the CP/M world and it's always appeared impervious to the challenges from other pc-compatible word processors. At least it always seemed impervious until July.

July was the month when many of the new word processing kids flexed their muscles, and the result was startling.

Word Plus-PC continued its strong move and came within a few sales of wresting the lead from *WordStar*. *MultiMate* arose out of nowhere to rank as the eleventh bestselling program of the month. *PFS: Write*, using exactly opposite tactics from *Word Plus-PC*, scored heavily.

Actually, *WordStar* sales didn't suffer; they're holding their own quite nicely, thank you. It's just that other products are grabbing off significant chunks of the larger market now available. Put another way, *WordStar*'s absolute market is stable, but its relative market is shrinking.

The products that did get hurt in July were both *EasyWriters* and *Volkswriter*. All three products plummeted not just out of the Top Thirty, but almost totally out of sight. Also impacted in an odd way was *VisiWord*. In June, it grabbed off a pent-up demand for the product during its introductory period and hit the charts. July results indicate that June's performance will not be as easy for VisiCorp to duplicate in the future.

The opposing strategies taken by Professional Software and Software Publishing Corporation would be an interesting study for marketing consultants. Professional Software took the field with a major advertising campaign, offering to buy back their product if the owner wasn't truly satisfied with it. The campaign's been running a year and, in conjunction with added emphasis on dealer support, appears to be paying big dividends.

Software Publishing Corporation approached the problem totally differently. They've been providing demonstration disks of the product to dealers for dissemination to potential buyers. There's been a huge run on the demo disks that is starting to translate into sales. The only certain knowledge to be drawn from these examples is that there's no one formula for marketing success yet in the microcomputer marketplace.

Two of the other big noises in July came from an unsuspected area—proven Apple software. Conventional wisdom had it that now that *1-2-3* and *Microsoft Flight Simulator* had paved the way, no other eight-bit translations would be able to strongly impact the pc market. Make no mistake, neither new product greatly resembles its Apple predecessor, but apparently SSM and Lightning Software weren't daunted by the challenge.

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Also available from Anthro-Digital: Visicalc Formatting Aids, The Executive Secretary, The Personal Secretary, and Executive Speller, Hebrew II and Hebrew II Plus, S-C Macro Assembler, QuickTrace, Amper-Magic, The Rental Manager, F.A.R.M. accounting packages.

SSM introduced *Transend 2*, a communications package, with big results. The product didn't bump *Asynchronous Communications Support 2.0* or *Crosstalk*, but it looks poised to tackle those two leaders.

Lightning Software introduced *MasterType* and, as it did in the Apple market, grabbed the lead among typing tutorial programs from *Typing Tutor.*

The entertainment software area continues to be much softer for the pc than many publishers had hoped. Microsoft's *Flight Simulator* remained one of the top sellers. Sierra On-Line's *Frogger* fared well, but all other recent entries dropped from the list. Regaining the list were *Zork I* and *Microsoft Decathlon*, two old favorites that had been eclipsed temporarily by the newer products.

It appears that more pc owners are using their computers as tools to develop their own application software as well as buying the best of the off-the-shelf application packages. The *Norton Utilities* jumped to eighth on the list, its best showing ever. In addition, the *Macro Assembler* surged in sales in July to regain the list.

That the pc market is becoming more diversified is also demonstrated by the continued strength of packages aimed at novices—such as *The Instructor* and *Cdex Training for the IBM Personal Computer*. On the one hand, there are the stronger sales of programming utilities and, on the other, programs for the novice are much in demand.

That diversity is further evidence of the maturing nature of the market and should be comforting to both pc owners and the third-party companies that support the market with products. ▲

IBM-franchised retail stores representing approximately 5.82 percent of all sales of IBM and IBM-related products volunteered to participate in the poll.

Respondents were contacted early in August to ascertain their sales for the month of July.

The only criterion for inclusion on the list was the number of units sold; such other criteria as quality of product, profitability to the computer store, and personal preference of the individual respondents were not considered.

Respondents in August represented every geographical area of the continental United States.

Results of the responses were tabulated using a formula that resulted in the index number to the left of the program name in the Top Thirty listing. The index number is an arbitrary measure of relative strength of the programs listed. Index numbers are correlative only to the month in which they are printed; readers cannot assume that an index rating of 50 in one month represents equivalent sales to an index number of 50 in another month.

Probability of statistical error is plus or minus 4.31 percent, which translates roughly into the theoretical possibility of a change of 4.68 points, plus or minus, in any index number.

the top thirty

This Month	Last Month	Index	
1.	1.	361.79	**1-2-3**, Mitch Kapor and Jonathan Sachs; Lotus Development
2.	3.	112.92	**WordStar**; MicroPro
3.	21.	99.97	**Word Plus-PC**, Andres Escallon; Professional Software
4.	2.	96.38	**Microsoft Flight Simulator**, Bruce Artwick; Microsoft
5.	4.	84.87	**dBase II**, Wayne Ratcliff; Ashton-Tate
6.	10.	53.22	**Asynchronous Communications Support 2.0**, IBM
7.	6.	47.47	**PFS:File**, John Page and D.D. Roberts; Software Publishing Corporation
8.	24.	43.87	**Norton Utilities**, Peter Norton; Peter Norton Inc.
9.	7.	40.99	**Home Accountant Plus**, Mike Farmer, Bob Schoenburg, Larry Grodin, and Steve Pollack; Continental Software
	8.	40.99	**VisiCalc**, Software Arts/Dan Bricklin and Robert Frankston; VisiCorp, IBM
11.	—	33.08	**MultiMate**, Softword Systems, Inc.
12.	12.	32.36	**Crosstalk**; Microstuf
13.	18.	24.45	**Frogger**, Olaf Lubeck; Sierra On-Line
14.	19.	23.73	**Smartcom II**, Hayes Microcomputer Products
15.	—	21.57	**Transend II**, Tim Dygert and Bob Kniskern; SSM
	5.	21.57	**Multiplan**, Microsoft; IBM
	—	21.57	**PFS:Write**, Sam Edwards, Brad Crain, and Ed Mitchell; Software Publishing Corporation
	—	21.57	**MasterType**, Bruce Zweig; Lightning Software
19.	14.	20.13	**PFS:Report**, John Page; Software Publishing Corporation
20.	9.	18.70	**The Instructor**, Jo-L Hendrickson; Individual Software
21.	—	17.26	**Cdex Training for the IBM PC**, Rohit Patel; Cdex Corporation
22.	16.	15.10	**Typing Tutor**, Michael Sierchio (Dick Ainsworth and Al Baker); IBM (Microsoft)
	—	15.10	**WordPerfect**, Alan Ashton and Bruce Bastian; Satellite Software International
24.	26.	14.38	**SuperCalc**, Sorcim
25.	—	13.66	**Macro Assembler**, Microsoft; IBM
26.	—	12.22	**IBM Pascal**, Microsoft; IBM
27.	—	11.50	**Zork I**; Infocom
28.	26.	10.78	**KinderComp**, Doug Davis; Spinnaker Software
	—	10.78	**General Ledger**, Peachtree; IBM
30.	—	10.06	**Microsoft Decathlon**, Tim Smith; IBM (Microsoft)

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